This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

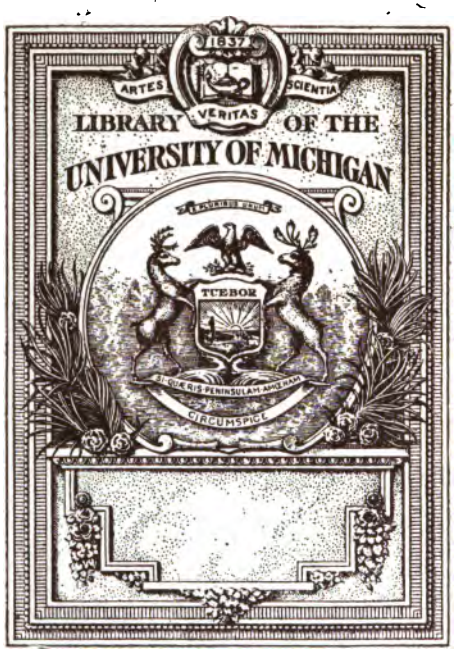
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


1837
ARTES
SCIENTIA
VERITAS
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
CIRCUMSPICE

QC
16
.S97
08

7/6

Supplies procurable

from:

Messrs Brentano

5th Avenue & 17th Street

New York

WILLIAM SUTHERLAND

William Sutherland as a Student in London

(From a sketch in oils by Mr. John White)

William Sutherland

A

BIOGRAPHY

By

W. A. OSBORNE

LOTHIAN BOOK PUBLISHING CO.
PTY. LTD.
MELBOURNE

COPYRIGHT

First Impression, August, 1920

Released 6-1-57 jm

AUTHOR'S PREFACE.

I have been aided in preparing this biography of William Sutherland by a number of his friends, who have supplied me with valuable recollections of his personality and work, and to whom I would now extend my thanks. I am, however, under special obligations to his sisters, and particularly to his eldest sister, Miss Jane Sutherland, whose devotion to the memory of her brother has very materially lightened my task.

372674

INTRODUCTION.

The work of the late William Sutherland was well known in detail to very few people by reason of its advanced character, but many Australians were aware of its high reputation. The signatories to this Introduction have taken steps, now that he has passed away, to place on record an account of his life and work. They have entrusted the fulfilment of this intention to Dr. W. A. Osborne, Professor of Physiology in the University of Melbourne, who has generously exerted himself to do justice to the memory of this distinguished graduate.

William Sutherland was known to a limited circle of friends, who appreciated to the full not only his ability, but still more his remarkable personality—an earnest, selfless, many-sided man removed from the affairs of the business world, asking only that he should be allowed to do a third of a day's work so that he might devote the remaining portion of the day to the studies that were dear to him.

Yet he was no recluse and brought to bear on worldly affairs a most original, penetrating and comprehensive criticism of human motives and tendencies. No appeal to help in matters of knowledge was ever made to him in vain; in fact, so affectionate was his disposition, that refusal was impossible.

The signatories have done all that is possible for them to render homage to the memory of a man who so materially enriched the world.

P. Baracchi.
J. W. Barrett (Hon. Sec.).
H. B. Higgins.
T. R. Lyle.
Felix Meyer.
G. A. Syme.
Geoffrey Syme.
G. F. H. Schuler.
H. G. Turner.

CONTENTS.

	Page
Childhood and Boyhood	11
At Melbourne University	19
Study in London	26
The Dedication to Science	36
Literary Work	52
The Scientific Achievement	68
The Man	89
Appendix	97

CHAPTER I.

Childhood and Boyhood.

WILLIAM SUTHERLAND was born in Dumbarton, Scotland, on 4th August, 1859. His father was one of those many Scots who have been compelled to fight for a livelihood from their early years, but who manage to acquire a fair education and who keep alive the book-reading habit. He was, moreover, artistic, an excellent draughtsman, and by trade a carver of the better class ornate figure-heads for ships. William Sutherland's mother was Scotch also, and possessed the intellectual and moral qualities of the race, never better displayed than in adverse circumstances. In 1864 the father of a rapidly growing family, six by this time, finding his health indifferent through a constitutional weakness, which, alas, he passed on to his children, determined to emigrate to Australia, though this meant giving up a career which was bringing in a comfortable income. He

had already tried emigration to America, but had soon come back, chiefly for climatic reasons. The five-year-old boy, William, was now a puny child who had already cost his parents much anxiety, and who, indeed, did not seem to have much grip on life. But the long voyage was the turning point in his physical state; with the sunshine he appeared to drink in health, so that when, at the age of seven, he went to school in Sydney, he seemed almost a normal boy in physique and well above normal in mind. In 1870 the Sutherland family came to Melbourne, where they finally settled down. The eldest son, Alexander, now a boy of eighteen and showing much promise of intellectual distinction, became a teacher at the Hawthorn Grammar School, and was studying in the evenings for his matriculation examination in the Melbourne University. William, seven years his junior, was sent to the Model School (a State or National school), then under a master of some individuality named Patrick White. The boy took kindly to his work, and may be said to have enjoyed his schooling as far as this is humanly possible. His teachers soon detected the exceptional brightness of his mind and marked him out as one showing

promise. At first he entered heartily into games, especially into cricket, in which he showed some proficiency, but in a few years his devotion to study and presumably an instinct arising from hereditary weakness made him give up the more active pastimes for walking. Here began that passion for the Australian bush which dominated or displaced every other recreation for the rest of his life.

After two years at the Model School he gained one of the Government Exhibitions of £35 a year for four years, which had been founded in order to carry promising pupils to the University. It was now necessary to go to a Secondary School, and as the Victorian Government had not then instituted the present useful High Schools, a private Secondary School (or Public School in the English sense) had to be chosen. His head master, Patrick White, recommended Wesley College, and to this school he went.

The choice was an excellent one. The head master of Wesley College was then Mr. M. H. Irving, late scholar of Balliol, who had in 1871 resigned the professorship of classics in the Melbourne University, finding school work more congenial. The second master, who had charge of mathematics and physics,

was Mr. H. M. Andrew, scholar of St. John's College, Cambridge, and late Professor of Mathematics in the Royal Agricultural College, Circencester. He reversed the experience of his senior by becoming, some years later, Professor of Natural Philosophy in the Melbourne University. With such men as these on the staff the general level of teaching was high. Pupils who showed special promise were given individual attention, and it reflects somewhat on our modern standards to find that senior boys in Wesley at this time were pursuing their studies into the calculus in mathematics and maintaining at the same time the British tradition of a severe discipline in Latin and Greek composition.

William Sutherland was a day pupil, and not a boarder, at Wesley. A fellow pupil and competitor in many examinations* describes him there as "quiet and reserved, shy one might say, in the presence of a number of boys, but when we were by ourselves all the shyness vanished and he would enter without any restraint into any discussion which cropped up. His speech was a little hesitating; one might say he had a slight impediment

*Dr. Felix Meyer, of Melbourne.

which, until you knew him and his mind, gave you the idea that his mental process was slow; but even in these early days one felt there was no dull edge to his intellect. One always felt his intense honesty. He was modest to a degree but he never shrank from combating a point in our argument which had been slurred. He was not very robust, and took no part in sports." The two masters of professorial rank had naturally a large share in moulding his mind. There was no indication at school of mathematics and scientific pursuits displacing classics; if anything, his boyish loves in the intellectual world were on the arts side. History strongly attracted him, "Freeman's Smaller History of Europe, he knew from cover to cover. Geography, especially map drawing and physiography, had great attractions, and Keith Johnson's Physical Atlas was long a sort of Bible."*

But there was another influence at work beside that of the school—namely, the home. It was a time of unrest in the history of thought; dogma and science were fighting a furious battle. Huxley, the trenchant apostle of evolution, was wielding the sword of com-

*Dr. Meyer in a letter to the writer.

parative anatomy, Spencer that of philosophy. Tyndall had delivered in one of the homes of conservative orthodoxy his famous Belfast address. Many a bright boy, attracted, as youth will be, by the side that attacks, and responding to the appeal to reason rather than to emotion and tradition, accepted the new doctrines and found himself in estrangement with his bewildered and angry parents. This setting of child against parent by the advance of science into realms hitherto regarded as sacrosanct continues in our own day, but the poignancy of the divergence is not as keen as in the seventies. Sutherland was happily spared this distress. The family had been members and regular attenders of St. Andrew's Presbyterian Church, but the new wine was too much for the old bottles and as science gained point after point the pastor became more reactionary. At last one particularly foolish utterance on Jonah and the whale proved too much for the Sutherland parents, who quietly detached themselves and became members of an independent body under Dr. Strong, who tolerated, if he did not encourage, wide latitude of doctrine amongst his intellectual flock. Both Sutherland parents were strong minded, the mother particularly

so, possessing a mental balance and a calm outlook on the great questions of life not usual in her sex at that time. The father could lay claim to some artistic skill, as has been said, and indeed earned a livelihood at this stage, first as a teacher of drawing in the Victorian Education Department, and later as artist and wood-block engraver for the illustrated Melbourne press. Added now to the influence of the parents was that of a band of four brothers and three sisters blessed with high talents in literature, art and music. The eldest brother, the brilliant Alexander, had matriculated in 1871 at the Melbourne University, winning an exhibition and was now passing through the arts course, gaining exhibitions and scholarships in mathematics, classics and English. After Alexander came another brother, George, who also gained high honours in the arts course. On his sisters—to whom William Sutherland was attached throughout his life by the most tender bonds of affection—nature also had dowered her gifts. It was not that art and music were cultivated as mere accomplishments, they were pursued with industry and skill, as well as enthusiasm, so that professional rank was attained. In such a home, amongst a large

family, versatile and quick-witted and steeped in an ideal atmosphere of mutual help and appreciation, the most formative influence could be found. He worshipped his mother, who was as much a companion as a parent, and to her we may trace in a good measure his unswerving veracity and honour. But what he owed to his brother, Alexander, was also something exceptional; it was with him that he discussed the vivifying work of Darwin, and from him, as well as from his parents, he acquired that cultured detachment from dogma which he preserved with unruffled composure throughout all the experiences of his life.

CHAPTER II.

At Melbourne University.

IN February, 1876, William Sutherland, formally entered the University of Melbourne by matriculating, gaining at the same time an exhibition in arithmetic, algebra and geometry. He was quite undecided about his future life work, and, if anything, inclined more to the arts side. What he actually did was to take out two courses, arts and engineering, leaving the decision of profession to a future date.

The University of Melbourne was then just twenty years old, but the sum total of her students throughout these years had barely attained to the thousandth mark. In this year, 1876, the number of matriculated students was 130 and were all males, women not being yet admitted to University courses. The Chancellor of the University was Sir Redmond Barry, perhaps better known to many Australians to-day as the judge who tried Ned

Kelly, the bushranger. The number of professors was five, though one of these, Dr. Hearn, by a device dear to the legal mind, had proclaimed himself Dean of the Faculty of Law, and not professor, and so could become member of the governing body. The remaining four were Herbert Augustus Strong (Classics and Logic), afterwards professor in Liverpool; Edward John Nanson (Mathematics), who had arrived the year before from England with Second Wrangler honours; Frederick McCoy, an Ulsterman, but without any University degree, who bore the burden of the whole of natural science, and who made Melbourne his debtor by elaborating his museum of natural history. The fourth was George Britton Halford, who carried the Medical School on his shoulders and professed Anatomy, Pathology, and Physiology. There were fourteen lecturers, some of whom gained professorial rank in a few years' time; amongst these was William Charles Kernot, lecturer, afterwards Professor of Engineering, one of those men with quick intuitive powers and a capacity to inspire students.

The University of Melbourne was at this period somewhat conscious of its motto "postera crescam laude." The actual buildings con-

sisted of a block forming an incomplete quadrangle which fulfilled the requirements of the secretariat and administration, included four professorial residences, contained the classrooms and laboratories for teaching arts, law, engineering, and all the experimental sciences except chemistry, and had finally surplus room for a small library. Close by was the museum, where Professor, later Sir Frederick McCoy, built up the great natural history collection, which was afterwards transferred from the University to the Public or National Library Buildings, and constitutes McCoy's chief claim to the gratitude of Victorians. More remote from these was the medical school—a small block in which teaching and demonstrations in anatomy, chemistry and physiology were conducted, and lectures delivered on the various subjects of the medical curriculum. These three buildings occupied but a small portion of the forty-acre area reserved for the University proper. North of this were the recreation field of sixteen acres and the four fine reserves of ten acres each for the four leading Christian denominations to build each its residential college. So far one body only had availed itself of the privilege, and the Anglican Trinity College was at

this time (1876) in full activity. The University grounds were separated by a wooden fence in the last state of disrepair from the surrounding district of Carlton, at that time but sparsely inhabited. The original soil in the University reserve had been largely removed by local residents, who helped themselves when they desired to create a back garden. Consequently, when the grounds were seriously taken in hand and a bold scheme of planting had been adopted, soil had to be imported at some cost. For many years the expenditure on the grounds was considerably above that on apparatus; in the year 1876, £467 were spent on the grounds, and £270 on apparatus—a distribution rather reminiscent of Oxford.

Sutherland's behaviour at the University was a continuation of that at school. He worked hard and avoided games, but became more addicted to long tramps in the bush, especially in the picturesque valley of the Yarra. There is one glimpse of the boyish spirit breaking out when, in the Engineering School, in the absence of the lecturer, Mr. Kernot, he, with others, set up wickets made of chair legs and had a lively game of improvised cricket with some fellow students, to

the great peril of the windows. But strenuous work was the rule. At the end of his first year he obtained the Exhibition in Algebra, Geometry and Trigonometry, and the Stawell Exhibition in Engineering. In the following year he attended classes in biological as well as physical sciences, and to his deep annoyance heard McCoy thunder against the Darwinian doctrine. In his last year at the Melbourne University he gained first class honours with the Scholarship in Natural Science, and third class honours in Engineering. The degree of B.A. was formally conferred upon him on 19th April, 1879.* The choice of a profession had not definitely been made, though his abandoning the practical exercises in engineering rather indicated that he had given up that study. But any definite choice was postponed by a fortunate occurrence. Every alternate year, from 1867, the trustees of the Gilchrist Scholarship in England had offered one of their scholarships, namely, £100 a year for three years, to a nominee of Melbourne University, but the offer had consistently been declined as not suffi-

*The M.A. gained by examination was conferred upon him in December, 1883.

ciently advantageous; moreover, the London University, by placing the Melbourne B.A. on the same level as its matriculation, had given considerable affront to the colonial educationalists. However, this year the Melbourne University Council reconsidered the question, and resolved that a student should be nominated. To their surprise they found that the offer to Melbourne had been withdrawn and given to New Zealand. But the trustees decided to be generous, and granted Melbourne her desire, and so in the University Annual Report, under date 31st May, 1880, we read:—"The Council availed themselves of this offer and nominated Mr. William Sutherland, B.A., to the scholarship. This gentleman left for England in August last, in time to present himself to the secretary of the Gilchrist Fund in the month of October, as required by the conditions of the scholarship."

The young graduate had a good training in mathematics and the theoretical parts of engineering, but his knowledge and attainments were not confined to what the University could give. As at school, the home influence still prevailed. He could play classic music on the piano and violin with some skill; he was fond of sketching in water colour, and

William Sutherland in his Twentieth year
(From a photo)

throughout his University course he had ranged over a wide field of reading, not entirely desultory, for his gifted brothers were at hand to guide his choice, so that, when he left Melbourne for Europe, he possessed not only a disciplined and well-stocked mind, but a facility and grace of expression that in many would have been regarded as prophetic of a literary career.

CHAPTER III.

Study in London.

ON 26th July, 1879, the steamship Kent, with William Sutherland, now barely twenty years old, amongst her passengers left Melbourne for England. We can picture the young man agog with anticipation of the historic sights he was soon to visit and of the masters in the world of thought whom he was likely to meet; but such visions were soon to be brutally obscured by another form of education on which he had not reckoned, namely, contact with humanity in the raw. So far his life had been secluded; the home circle with its literature, art, and science, had attracted him far more than any external friendships. Of the ruder aspects of life he could only have had remote suspicions. The collection of human beings, which make up the passenger list of a ship, has always some bizarre features. Then, too, the mental-

ity of the voyagers is not that which they possess on land, due possibly to the constant agitation of the ship and its environment, to the smallness of the numbers, the relative isolation, and the unnatural limiting of freedom. It would seem that the passengers of the ship Kent were by no means a choice company. There was the usual flirtation of married and single, and the usual vigorous patronage of the bar, with the addition of noisy quarrels and vile langauge. His table mates were a wild Irishman, who disdained forks, and a broken-down actor, who bellowed nonsense in his cups. Then came a touch of tragedy. A wretched woman in the steerage, separated from her husband, had given birth to a baby and had died, as a result of a drinking bout. From the saloon, where a drunken quarrel was going on when this was announced, the sensitive young student went up on deck to get a breath of air. "I was in the middle of a melancholy walk along the deck when the body was carried up to the smoking room, and as it passed me a gluff of brandy, sour milk, and dirt came from it, and gave me such a turn that I had to lie on the deck for a quarter of an hour." Next day, when the body had been committed to the deep, a sailor came

along with a scowl—"It's the first ship I've been in that the captain didn't give a grog all round. Damn her, what was the good of her dying?" The letter to his home that tells of this event has evidences of considerable emotional upset, as well as the first pang of an acute home sickness. His reflections made in a letter written at the time are worth quoting: —"On thinking over the reason for the inferiority of the lot on board, I came to two conclusions—firstly, that perhaps through seeing hitherto only a limited circle of people without any moral blemishes, I have got a wrong idea of what the average character was, or ought to be; secondly, that many of the people going home were partly those unsuccessful in the colonies through their want of moral tone, and, partly, the rolling stones that gathered no moss, but plenty of dirt and filth."

Fortunately for his peace of mind, a mild adventure requiring action occurred as they neared Suez. In the night the ship ran aground, the engine stopped, and of course, all the passengers came running on deck. "The moon almost out at full, was hung at an altitude of about thirty degrees in an intensely clear blue sky, shading off to a lumin-

ous haze that showed in fine relief the soft purple of a range of hills a little inland, while in the middle distance a strip of yellow moonlit sand, backed with dark rocks tipped here and there with silver light, was laved by a blue succession of waves rhythmically lapping on the beach. The moon laid a pathway of silver from the shore to the ship, and cast her bright light on the long row of faces at the vessel's side."

A passenger, who held a mate's certificate, volunteered and was gladly allowed to work round the ship, with the sounding lead, and was helped at this task by young Sutherland. Then came the call for volunteers to shift cargo in the hold, and this gave the interested youth another experience. At last the ship was got free, and pursued her voyage uneventfully to England.

Once in London (Sept., 1879), William Sutherland soon settled down in lodgings, where his vigorous piano practice rather disconcerted an old-fashioned landlady, and then entered University College as a science student, taking physics, chemistry, and biology. Whatever had been his expectations of scientific work in London, they were clearly not realised, for his letters written during his first

year show that he was unhappy. The chemistry lectures, under Professor Williamson, he found opinionative, out-of-date, and boring, not only to himself, but to the other hundred and twenty students. The practical work in chemistry was meagre, and the equipment poor. It must be remembered that Williamson had then spent thirty years as a professor of chemistry in University College, and that his great researches had been carried out in the fifties. But youth is not tolerant of age resting on its laurels. The lectures of Professor Ray Lankester he found breezier, and containing the latest discoveries and views, but he had been over the ground before, and his youthful criticism of Ray Lankester was that, in too slavish devotion to Huxley, he went into great detail with the anatomy of a very limited number of animals, whereas his old professor in Melbourne, McCoy, had taken a broad survey of comparative anatomy, beginning with the lowest types and working up to man. A little naively the youthful critic asserts:—"Strange to say, though an enthusiastic Darwinite, Lankester would not turn out so many believers in evolution as McCoy, an arch anti-Darwinite." McCoy's method of starting with

primitive forms was dictated, one may say, as much by the first chapter of Genesis, as by any theory of teaching. Of Carey Foster there is no comment until next year, when a warm admiration arose. Had he been able to develop some interest in his work he would have been less unhappy in his first year of London life. He, of course, felt very much alone, and his was not the nature to make friends easily. Then again, like all Australians, cultured or uncultured, who visit Europe, he was horrified at the poverty existing alongside extravagant wealth. But, above all, the young student was exceedingly homesick. "I was delighted with the last little sketch you sent me—sweet and realistic. They are inexpressibly dear to me, these little sketches—delightful whiffs of the old home atmosphere. Last winter I saw a poor Italian organ grinder, miserably poor, and clad in rags, that let in more cold wind than they kept out; his sides had not carried a good dinner for many a hungry day. I was struck with the wistful look he gave at the basket of a passing flower girl—the first primroses. The girl passed on and he followed her with eager eyes, but he seemed to heave a sigh and settle down with a blank look to

turn the monotonous handle. But just then a window went up, and there was the rattle of a copper on the stones. The poor fellow pounced on it, and darted off along the road, leaving his organ to take care of itself. In a minute he returned, caressing a little bunch of primroses. When I get a home letter I always think of the Italian and his primroses." And again, "If I chance to pass an open window from which sounds at all suggestive of a family gathering come, I feel myself scowling with envy. When I started a year ago I had no idea what it meant, and if I had to choose again without a moment's doubt, I should elect to stay at home."

In the Preliminary Scientific Examination for the London B.Sc., William Sutherland gained second-class honours in experimental physics. The same position was won in the same subject in the Intermediate Examination. Then came the great preparation for the Honours Bachelor of Science. In his last year of work conditions were much more agreeable. A number of practical experiments in physics developed into minor researches. Professor Carey Foster took an interest in the young Australian, entertained him at his house, secured a seat for him at a

lecture by Helmholtz, opened up his library for his use, and gave him the run of the laboratory. These attentions could not have been paid to a more responsive student; the name of Carey Foster henceforth evoked only feelings of affection and gratitude. The University work of his last year was interrupted by the arrival of an uncle from India who, having put up at the same lodgings, took seriously ill and died there, after days and nights of fever and pain. To a sensitive youth this experience meant considerable agitation of mind, but his duty was to go on with his work, and this he did. Not that academic honours appealed to him highly. Unlike the majority of students, he would spend hours upon journal reading, and experiments dealing with some little research on self induction or the action of temperature on the potential developed by contact of dissimilar metals, or again, he would indulge in a burst of reading on the latest investigations in electrical science, knowing well that these contributed only a little to his chances of success at the examination. "In the London Honour exams. you cannot count your gain beforehand; they wander all round the subject in an erratic way, and no two sets of exams. are

alike. In this way the all-round man has, on the average, the best chance, and to this I trust. I may catch a Tartar, and figure as a Third Class Honour man—a disaster which would not greatly disconcert me, however. A University Honours List is no more the roll of fame than a State school prize list published in the [Melbourne] 'Argus.' It sorts you out for commercial purposes, and gives you a brand—superfine, fine, or medium—like carrots or pig iron. Still, it is a little nicer to be a champion potato than a common spud." During this year's intensive study his mental refreshment was found in music and visits to the art gallery, and his physical needs were met in week-end walks along the tranquil valley of the Thames. When the last lecture had been heard and the College session was over, he did a wise thing in joining a young artist friend, Mr. John White, in an old-world village near Helstone, Cornwall. Here, in beautiful weather, the final preparations were made for the coming mental contest. The result of that contest can be found in the Calendar of the London University for 1881—"First Class Honours in Experimental Physics: William Sutherland, University College." First place and the Clothworkers' Scholarship

of £50 for two years; then quick packing and an eternal farewell to England!

Burningly anxious though he was to join the beloved family circle in Melbourne, he took the opportunity to spend some five weeks in quick travel through France, Germany and Italy. He had already, in the course of his study, found it necessary to acquire at least a reading knowledge of German and Italian, in addition to French, and this stood him in good stead. What he saw in the galleries of Italy remained an abiding possession. With most travellers, and even those to whom art means something, the recollections of a hurried tour soon get blurred as the years pass by, but no one could talk to William Sutherland in his later life on art without being impressed with the extraordinary detail and accuracy of his memory regarding every picture and piece of sculpture that he had seen on this short tour.

He arrived in Melbourne in February, 1882.

CHAPTER IV.

The Dedication to Science.

THE question of his future career was still undecided, though no doubt existed as to the direction it would take. Already, in London, he had tried his prentice hand not exactly at journalism, but at writing ephemeral articles for the press. He contributed a number to the "Madras Times," of which his uncle was editor, but this work cut too much into the time devoted to his university studies, and so he gave it up. He had other and more serious literary ambitions, about which something will be said in the next chapter, but he entertained no doubt that his future belonged to science; other activities were to be recreative. Writing home from London about some wax anatomical studies by Michael Angelo, he suddenly breaks out into an expression of a great truth, of which his own life was to be an illustration:—"To find the bent of one's inclina-

tions and abilities, and to follow it out with the whole soul undoubtingly and unhesitatingly, is the only recipe for genuine happiness."

Professor Carey Foster had assured his pupil that a career in science was awaiting him in England, but the call of the old home in Melbourne was too potent. He now found once more unbounded joy about that happy hearth. Music, art, a little gardening, long walks through wild bush land, and assiduous work at his desk and at the library, filled up the day; the evening was devoted to literature and song. The biographer may digress for a moment here to mention how fortunate the great Australian cities are in their public libraries. Much of Huxley's wide knowledge of English literature was acquired during his enforced leisure in Sydney, and the fine Melbourne Library, which claims to be the greatest south of the Equator, has often brought happiness to the scholar and the investigator. It certainly did to Sutherland, who never seemed to lack any journal, brochure or book that contained the material he required for his researches.

Unfortunately, bread and butter had to be earned, but very fixedly Sutherland deter-

mined that what money he made should be that minimum which brought the necessities and the very few luxuries he desired. Contentment was to be found in creative work. In March, 1881, he had written to his mother: —"You say you hope there will be a good prospect for me when I come out. Well, really, for myself, I do not care—let me earn my plate of porridge for breakfast, a chop for dinner, a crust for tea, an occasional seat in the pit, and enough to keep the piano tuned, and I am content. What does a big salary mean? It means using your time and your brain. And what is the big salary for? To spend on carpets and drawing room suites. You lay out your brains to walk on and sit on." Many a youth with ambitions in science or art has made the same resolution, but how few have held fast when manhood has advanced? William Sutherland was one of the few. In July, 1882, there came from Ballarat the offer of the Superintendentship at the School of Mines, with a salary starting at £500 and rising to £700 per annum. But Ballarat was half a day's train journey from his home, and there was no great public library there. Without hesitation the offer was declined. A certain amount of coaching and,

at the end of the year, examining for the Melbourne University matriculation, brought in some welcome guineas, but such work was looked on as drudgery, which often interrupted the exciting pursuit of a discovery in molecular physics. He tried his hand at invention, but his hopes of commercial success were very subdued. Writing to his brother George he states:—"I tried to make the chief pleasure in working it out a purely intellectual one, the mere pleasure of nursing your intellectual child—the pure idea. No pleasure in life equals that of a man who, in the quiet depths of his own mind, associates with his one darling thought. No delight equals that of the bright intoxication when you feel your thought quick within you. If, too, the difficulties of opening up the process commercially sometimes seem unscaleable, think of the poor devil of an author, with his glorious plays locked up in manuscript and bursting to get out, but alack, no outlook, or apparently none; but both inventor and playwright may rest assured that when process and play are good enough they must find an outlet and take their fair rank." Nothing came of these inventions, unfortunately.

In 1884 the Adelaide chair of chemistry

was advertised. Sutherland thought himself well equipped for the post. He had been reading deeply in that borderland between physics and chemistry, which was soon to expand into the blossoming territory of physical chemistry, and realised his advantage in mathematical equipment over the chemists of the day. But his feelings were mixed:—"The chief inducement with me is the chance of a laboratory for research. I have tried to work at one or two things with the published results of other men's experiments, but have been invariably stopped short at some point through want of experiments of my own." And again:—"I thought the Adelaide professorship would have been settled by this time, but it is not. I am very mixed in my feelings over it. I think my strongest motive in wishing to get it is to please Mamma. To see one of her sons a professor would be a real joy to her. I suppose I look like a rudderless barque—a man without a career. It suits me very well to work away as at present if I could only get a certain congenial source of a small income and keep my leisure for the immense amount of work that has to be tackled." Not in the least disappointed, he saw this position going elsewhere, and with something like relief plunged

again into his researches. In March, 1886, he writes to his brother in Adelaide:—"Since coming back from Dromana* I have been in fine form for work. . . . I have a paper all ready to send off to the 'Philosophical Magazine,' or the Royal Society of London. My head is churning now with theories of molecular force for liquids and solids—hyperbolic and parabolic for gaseous molecules; elliptical for liquids; but in solids the law changes and the question is how?" In June of the same year he writes to his brother:—"Sometimes I regard myself as a very enviable creature, earning little enough, it is true, but with no outside worries or duties—working away in the quiet house—working to a continual accompaniment of Chopin, Schubert, and Beethoven." Then again on 22nd Feb., 1887:—"Just this afternoon I have brought about a year's work to a successful conclusion. . . . I will soon have a solid paper

*The beautiful country home of his brother Alexander, whose book on "The Origin and Growth of the Moral Instinct" was written here. Alas, the financial troubles of the country at this time forced him to give up both leisure and country home.

ready for the 'Phil. Mag.' Lots of glorious work ahead! Before resuming scientific operations it will be necessary for me to earn a little coin. For the last year I have been slipping along with just enough money for bare existence. I should like now to get some means of putting a little money to the good, so that I could settle down to a couple of years of unbroken work. I cannot tell you how delightful life is for me when I can go straight forward on the path of research—how weeks and months fly without a heavy second in them except such as are interruptions for cash-earning purposes."

On 22nd May, 1887, he writes again to his brother:—"I have been going in for fresh applications of my molecular theory, and going rather strong, so think, I have had to take half a week's rest! But I see a variety of beautiful applications opening out, at least I think I see them. The worst of work of this sort is that it grows almost too absorbing, so that the work-a-day drudgery becomes more and more objectionable. As an attempt to open up a means of earning a little money I sent a sub-leader to the 'Argus' last week, and saw it appear in yesterday's (Saturday's) 'Argus.'" Again, on 26th June, 1887:—"I

have been getting on satisfactorily with my work. The only difficulty is that it widens out rapidly. I could comfortably keep half a dozen computing clerks going now, but I have to buckle to and do this work myself. It would be hard to give you an idea of how one piece of work leads on to another."

How pleasant his life appeared to him is shown in many letters; take, for instance, the following of date 21st August, 1887:—"The first part of my article on the Law of Molecular Force has just appeared in the July number of the 'Phil. Mag.' I intend to start work to follow on again very soon. The house still rings with the very best music. Quiet, unconscious culture goes on. I sometimes fancy how Epicurean my life would seem to a man engaged in a hard fight for the necessaries of life, and with no leisure for self-cultivation."

Lack of facilities for experimentation frequently gave trouble:—"I have been making pretty fair progress with my scientific work of late, but have lost a good deal of time through the difficulty of getting data quite as accurate as I require. However, there is no cause to grumble; I am very thankful for the fine lot of experimental work which

is at my disposal. . . . We have been getting exquisite pleasure out of a book of songs by Brahms—also dozens of magnificent songs of Schumann's."

In 1888 Professor Andrew, of the National Philosophy Department of Melbourne University became ill, and in a voyage undertaken to restore health, died rather suddenly. William Sutherland was appointed by the Council of the University to act as lecturer on physics until the chair should be filled. But already, on 27th November, 1888, occur the words in a letter to his brother:—"I am sick of routine work, but am rejoiced to think I have a modest little sum of money on hand with which to go in for a good year's research next year. There is no joy to compare with the quiet, yet ardent prosecution of one's thoughts."

When the death of Professor Andrew was known, applications for the chair were invited locally and in London. Acting a little quixotically perhaps, Sutherland sent in his application to London and not to the local committee as he did—"not care either to hit or miss the place, except in straightforward competition." Moreover, he adhered so punctiliously to the embargo on personal canvas that the fact that he was applying was not

known in University circles. "I am almost neutral as regards desire to get the post; the duties of it would interfere for sometime with my original work, which I am eager to resume with vigour. On the other hand, the honours of it I should value highly for Mamma's sake, who would like to have a son wagging his head in the secular pulpit or professorial chair. The funds also would provide for future work; but present work is in itself the pleasantest." In a few months' time he learned, through the press, that the new professor had been appointed. This was Professor Lyle, with whom he soon established cordial relations. About the same time came a letter from London stating that his application for the chair of Music (*sic*) had been received! Such are, or were, the ways of Agents-General. But no one heard of repining from William Sutherland. The matter was settled, and so, with a light heart, he plunged once more into his researches in physics. A suggestion from one of his brothers that he should write a popular account of his discoveries led to the following reply:—"Your idea that I ought to advance my molecular speculations in a popular form will hardly hold. If it were a matter of

hygienic discovery or a practical matter that affected a large public, it might be one's duty to push for publicity; but my work concerns physicists alone, and ought not to be popularised until accepted by them. In pure science it is a matter of ten or fifteen years before work begins to bear fruit, and the scientist must share the patience of the orchardist; moreover, I do not care about publicity; there is so much of an impure form of it. If the work goes well itself, life is as jolly as it can be. In a fortnight I shall have to plunge into a thousand exam. papers, when good-bye research for a spell." He refused all honours as he refused to entertain the idea of popularity. When some influential men of science approached him to receive his assent to a nomination for the Fellowship of the Royal Society of England, they got the rather disconcerting reply that the Proceedings and Transactions of this Society were available in Melbourne, and he was unaware of any other advantage which Fellowship would bring!

After the Melbourne University fiasco he sought no more academic posts, except the chair of physics in Sydney, for which he was disqualified by age. A suggestion concerning a technical school at Perth, Western Australia,

was turned aside without hesitation. But in 1897 Professor Lyle obtained leave of absence for the academic year, and at his suggestion William Sutherland was appointed lecturer in physics. It is possible that the strain he felt when handling large classes weighed with him in his subsequent renunciation of academic office. Moreover, for the tedious administrative duties attached to the chair he entertained a distaste. One must, however, regretfully admit that it was a loss never to have had a laboratory, academic or otherwise, in which to put his hypotheses to the test of fact. Fortune was unkind to him in this regard, and so the only experiments he conducted were a few in his home with very simple appliances. Whether he would have become a good experimenter in a well-equipped laboratory one cannot say, but he did not possess a highly developed mechanical gift, and in the absence of expensive apparatus, the direction of work indicated was, perforce, that which he took.

In a country with such a small population as Australia a specialist in a difficult branch of a recondite subject cannot expect to find others interested in the same theme, and with whom, therefore, discussion can be profitable.

Intellectual isolation is unavoidable, but no complaint of this was ever uttered, and probably was never conceived, by William Sutherland. By careful reading of the journals and by occasional correspondence, he kept in touch with all recent work in physics, and with much in chemistry and other subjects. Free from the exacting administrative duties of an academic teaching post, he could spend much time in following up the current literature of science as published in the chief European and American journals. His industry in this direction was exceptional. With him it was a matter of honour that a man of science should be abreast with his subject. If he lagged he was unfaithful to his high calling. With the University he kept in touch in so far as the University could give him original matter in research; with its social and ceremonial side he had no sympathy.

By a little coaching and examining, and by leader writing in the "Age" newspaper, he made a sum of money pathetically small when contrasted with the income of a business or professional man, but sufficient for his needs Nor was there any evidence of stinting in the comfortable home. With his sisters and brothers he could act the host gracefully and

efficiently, but the guest had to be fairly quick-witted to follow the rapid play of thought that passed to and fro in conversation.

William Sutherland's whole being was truly dedicated to science. To that mistress he offered all he possessed . He gave up his sketching, his ambitions of literary activity and much of his piano playing, but still found unbounded joy in music, literature and art as a listener, reader or gentle critic. His brother John, who survived him for but a short period, has given the following brief description:—"So very even was the tenor of his life from this time onwards that the events of one year would almost identically represent all. The years were full of exciting interest to him in his work and recreations, and yet he did all in such a quiet and unobtrusive manner that many of the friends who frequented the house had no idea that he was anything but a studious man, who might have made his mark if he had been ambitious. He never left home for any length of time by himself—sometimes he would take a walking trip for a day or two —once he took a trip to Adelaide, and twice to Sydney. His manner of working was very simple—any part of the house suited him—sometimes he worked in his own room or the

study, balcony or garden—it made no difference to him. He would lift his materials and carry them off if anyone wanted the room he was in. He could work away with several people talking without seeming to be disturbed. If anything had to be looked after in the house, such as a leaking tap, or gas escape, or any of the many little troubles that occur in a house, he would be called, and respond in a cheery manner, coming tearing downstairs as if he had just been looking forward to that pleasure. He would spend the best part of the day in putting something right, and always look upon the doing of it as recreation. On ordinary days, after having worked for a couple of hours in the morning, he would come bounding downstairs, and look about for his mother, who might be sewing, ironing, or baking, and sit chatting with her (this was one of his greatest delights) about half an hour. Then he would go and stand behind whoever was at the piano, and in the same way visit everyone who happened to be in the house, and then settle down again to study. In the afternoon he would go for a long walk. In the evening he would study again, and read some literature. He was passionately fond of music, and practised on the

piano enough to give him pleasure all his life in accompanying himself in singing the great songs. He also practised the violin, but did not keep that up, as it required too much time and effort to be really enjoyable."

CHAPTER V.

Literary Work.

LIFE in London in the heart of the publishing world had awakend or intensified literary aspirations. Wide reading and some frequenting of the cheap seats in the theatres led to the drama as the direction in which these ambitions tended. Here and subsequently on his return to Melbourne a number of plays were written—libretto, comedy, and melodrama—all sweet, wholesome stories of love triumphant. A more serious effort was a novel—"An Atheist's Wife." A young girl brought up in a home of fierce orthodoxy meets and loves a teacher, whose reading and thought had led to an abandonment of religious profession. The parents interdict the wooing, and a struggle ensues in the girl's mind between duty to her parents and the call of love. She yields to the latter and flies from her home to be married

in a registry office. She is now regarded as a lost soul or as one dead by her unbending and tyrannical father. After a short period of happy married life, in which much practical goodness is displayed, disaster follows disaster. The story is told with some power, but an unfortunate title and too much freedom for the time in analysing some of the main essentials of established belief kept publishers from accepting the book.

As has been stated, the first attempt at writing for the press was made in London during student life. Soon after the return to Melbourne a series of "Science Notes" was contributed to the "Adelaide Observer." In 1889 the Melbourne "Argus" invited him to contribute a number of articles on the machinery section of the exhibition then being held, and this he carried out with success; his description of the printing press particularly exciting much appreciative comment. But the real opportunity for doing good work arrived in 1901, when his friend, Mr. Percy Wilkinson, then Analyst to the Health Department, introduced him to Mr. Schuler, the editor of the "Age," and arrangements were made for a series of articles. These at first dealt with technical and practical topics, but by August,

1901, the new contributor had found his feet, and the delighted proprietor and editor of the "Age" found they had secured no mere populariser of science, but a writer of flexible English, who could pass easily from theme to theme and from style to style, at one time administering a dignified rebuke, and at another exulting in an outburst of impassioned and melodic prose. The first indication of the purely artistic quality of his writing appeared in a leader in the "Age" of 31st August, 1901, which may be given *in extenso,* as it illustrates his deep joy in nature, and is typical of a style remote from the restrained and coldly logical exposition of his scientific work or the trenchant English with which he would advocate a reform.

"The reception of the Australian spring is truly joyous. Unworn by the long, grim siege of the northern European winter, we do not hail the spring with that poignancy of transport that breathes the sigh of relief almost as strongly as the sigh of pleasure. Winter with us is merely the quiescence of autumn, prolonged till we are well rested from the heat of summer, and our renewed energy and refreshed spirit await but the touch of spring to stir through us with that upwelling of ecstasy

which is only too faintly recalled by the lyrics of our master poets. Nowhere in the world does spring announce herself with so lovely a splendour as in Australia. Along every river, up the tributary creeks, on the steep slopes of the gullies, our wattles, fair forest trees, burst into such a passionate profusion of golden blossom as no other country can rival. For miles and miles they line the natural avenues of brimming water, they gather into groves where streams meet, and everywhere they pour upon the cool air their soft fragrance, as sweet as that of woodbine or eglantine, but sweeter far to the Australian abroad, when it floods him with memories of home in the springtime.

"How darkened was the vision of those early authors who could write of the Australian colonies as lands where bright blossoms were scentless, and as having for the dominant note of their scenery 'weird melancholy.' Of Byronic gloom in which the unacclimatised malcontents would steep it, our landscape will plainly have none. It smiles forth a serene gaity, contagious for those who bring to the intercourse sane minds and sound bodies. Who could wish a blue sky to beam softer than ours along the horizon, or deeper in the

zenith? The gum tree, fiercely misunderstood by the laborious pioneer wresting his little clearing from its vast forests, is only now beginning to be appreciated at its true worth by a generation that, through an easier and gentler contact with it, has come to love its manifold beauties. What a rich variety of loveliness the young foliage of the different species presents! In the blue gum sapling each of the broad sculpturesque leaves is frosted with a bloom as delicate as that of the plum or peach. In other species a dreamy purple mantles through the green beneath the bloom with a tender harmony that would make a flower famous. In others again the red of the young rose leaf is surpassed; for, by its translucency the young leaf shows against sky or sun a range of tone from ruby red through sunset gold to oceanic green, that would have inspired the mediaeval artists in stained glass. Nor is the glory of the gum tree foliage confined to its youth; in the soberer hues of its maturity its tones of olive and russet green give to the cultivated Australian eye a quiet relief from the general brilliancy. Our Australian painters, a devoted band, are now, though with the scantiest material encouragement, interpreting for us the lovely

quality of colour in our gum trees, a quality that could not but escape the attention of those who brought to Australia young affections already pledged to weeping willows, trim hedges and the positive greens of the English landscape. The great eucalypts are only to-day coming into their rightful artistic heritage; even the dwarfs of the plains carry their twisted boughs with a picturesque suggestion of strength, and wrap their scant array of leaves around them with the nonchalance of a contented poverty. But in the ranges the columnar spring of their great pearl-grey trunks away towards the blue vault makes our mountain forests a living temple to the joy of life. The Australian love of the gum tree is not yet proportionate to all its merits amongst the forest trees of the world. Thanks to its mellowed greens, which to strange eyes seem so sombre, it is able to absorb sunshine with the highest efficiency, as its unequalled rapidity of growth bears witness. Luxuriating in times of plenty, it can pass unscathed through the fiercest droughts, if only fire will spare it. How tonic the air into which these brave trees shed the vapour of their sharply aromatic oil, especially to the climber on the ranges, who

cannot breathe a deep enough breath for the heroic needs and deeds that stir within him.

"The songsters that make themselves most heard in the musical welcome of the Australian spring, though they fail to touch the sentimental chord within us, give such a rollicking jollity to the outpouring of their high spirits as puts us into too genial a glow of good humour to be critical. It is certainly not the classical nightingale's tumult of mournful passion that our magpïe gives us; but on a clear spring morning when he perches on a gum bough, between two of his buoyant flights, and with head thrown back and wide-gaped bill, according to his own original methods of voice production, tumbles out his fantastic wild intervals, he expresses his own cheery dare-devil independence to perfection. That care must be heavy which is not dispelled by a chorus of magpies saluting a spring sunrise in a bush clearing. And when the laughing jackass appears, comedy has it all her own way. Poor humourist of the woods, like his human fellow, he gets most laughed at when he is most in earnest. His very love poems are put in the funny column. Magpie and jackass unaided could laugh the 'weird melan-

choly' theory of Australian scenery out of countenance.

"The almond blossom has come and gone, the pink of the peach blossom is showing. Soon every forest clearing will display the emerald green of the young crops thrown into dazzling relief by the tender pink and creamy spray of the bourgeoning fruit trees. The blue column of wood smoke rises gently from the settler's home, embowered in blossom and bursting leaf. Under its roof a brave man and a brave woman live in strong self-reliance the soiltary life of the bush. In their suburban cottage the townsman and his wife, tending their little garden with new spring zest, feel but at a far remove the farmer's primal instinct for productive life in the open air. In town or country, to respond to the call of the spring, is to retain one of our most precious capacities for joy."

As another type of style, the following may be given from the "Age," of 2nd August, 1902:—

"Art and literature have familiarised us with death in the form of an old reaper carrying a huge scythe that his mere skeleton arms can yet swing with a terrible stroke. But if we reflect on the remorselessly automatic

operation of death throughout animate Nature, we might be more inclined to embody it as a sleek black harvesting machine reaping impassively its crop for oblivion. Of the human race alone a number equal to the whole population of Victoria disappear in the Valley of the Shadow every fortnight. Death is, perhaps, the only commonplace thing that we do not feel to be so. Hard experience has taught us all to look upon its visits as the surest thing in life, yet its knock at the door thrills us with the same pained surprise as though it were a portent out of the unknown. Indeed, death has so far tyrannised in our conceptions of life that a once current physiological theory of the nature of life regarded the whole of the physical forces of nature as making for death, against which a mysterious vital force carried on a brave struggle during the life of a man, only to be utterly defeated at the end. Religion, in many of its forms, seeks to assure the mortal that the seeming defeat may, if he chose, become the most signal victory of his spirit over the poor clay that is dropped at last. This attitude of contempt towards the body is one that the physiologists cannot approve of; nor, indeed, does the ordinary man give it practical endorsement, if his real sentiments

are to be gauged by the trouble he takes over feeding and grooming the precious carcase. The medical speculative thinkers who strove before the era of experimenting to reconcile religious aspirations and theories with the facts of their professional experience, were hard pressed to form any working idea of how the soul could cross the gulf between spirit and matter, without partaking largely of the nature of matter. Some took refuge in a revival of the old Greek idea that matter and spirit might communicate with one another through an intermediate vital principle, as a lord may rule his domestics through a butler. Death, according to them, was but the resignation of the butler, whereupon my lord betook himself to his native heaven, or the other place, and the clay tenement was given over to the riot of corruption. . . .

"To dip with the mystic into the cold waters of death is not a bad discipline occasionally, if we can be sure of clambering back to the ordinary interests of life with vitality at the full glow of the strong swimmer's, when he shakes the brine from his limbs. But the danger of bathing too long in the healing waters of mysticism is that the active exertion of swimming merges imperceptibly into the

passive drifting of a frozen corpse. The inability of the sensualist to give death an occasional brave and grave look in the face is the most indutiable sign of the craven that he is. Excessive fear of death argues a latent callousness, like that which now seems the most appalling result in the historic outbreaks of plague in great cities. Freed from morbid exaggeration, the contemplation of death is necessary to a sane understanding and enjoyment of life."

It was not very long before the editor of the "Age" pressed William Sutherland to join the staff of the paper, offering a much larger salary than was being earned by examining and occasional coaching. This offer was refused, and for two good reasons. His life work lay in science, and must not be interfered with; and secondly, his detestation of the tortuous paths and quaquaversal compromises of politics was too great for any monetary advantage to subdue. So he remained a contributor merely, his leaders being published in the Saturday issue of the paper, though special articles would appear from his pen from time to time on other days. It would be of no service in a biography of this scope to give a list even of the titles of the many leaders and

special articles contributed for some ten years. Naturally the topics covered a very wide field. But some outstanding characters may be mentioned. In the first place recent science was popularised in an admirable manner. Even so recondite a problem as the instantaneity of gravity could be expounded so that almost any reader could grasp the essentials. Occasionally this task was rendered very difficult by the necessity of explaining some mutilated cable message expressed sometimes in wrong terms, or one that purported to come from reliable authorities but needed critical reception, as when one particular cable announced that in an honoured laboratory life had been synthesised in gelatine by the action of radium. In all such cases admirable judgment, always justified by later news, was displayed. But popularised science occupied after all but a small fraction of the total journalistic output. Of the remainder it may be said that the outlook was that which might be expected from a cultured man of science. The experimental study of natural phenomena was to be widened in the schools, so that he who was ignorant of the scope and nature of science could not be accounted educated. All matters were to be judged on their merits, and

compromises and expediency relegated to a much less determining position. The necessity of a knowledge of science being possessed by statesmen and manufacturers, and the possible consequences of a lack of such knowledge were stressed continually. The education given in the English public schools trained men to be pro-consuls amongst savage or semi-savage peoples, but in other respects was much open to criticism. The training for appearance rather than action, and the inculcation that the expert must be subordinate to a non-expert administrator, were elements in English education which he dreaded being retained in Australia. He believed in the secondary schools of Australia preserving their individuality and pronounced against too much integration and standardisation. The subject of women in the State was frequently dealt with, and always broadly. Women should be left unhandicapped to enter all avenues of human action. In national and municipal government, in the professions, as architects, and even as engineers, woman's help was necessary. Many articles were written on University reform; that institution he regarded as not sufficiently democratic, and not sufficiently in sympathy with Australian

aspirations. The Federation of Australia had just been accomplished when his connection with the "Age" took place, and a number of articles by him urged persistently the continuance of this integration in all those departments where central guidance and uniformity of standards were indicated. The electrification of railways was advocated repeatedly and forcibly. He did not write mere generalities, but with his engineering knowledge and wide acquaintance with physics went into considerable detail. Alas, he did not live to see the electrification of Melbourne's big suburban traffic, of which scheme he has more claim to be called the father than any politician; nor the utilisation for power of the huge deposits of Victorian brown coal, which his mental vision clearly foresaw. The beautification of Melbourne and the Yarra gave rise to some stimulating articles which have been partly acted upon. He attacked the dust fiend and the smoke nuisance constantly. With political wrangling he refused to besmirch himself. His only adventures into this arena were to make some criticism of socialism and to suggest a better system of voting, favouring the "mark vote," that is to say, the voter was to express his

estimate of each candidate's qualifications in a numerical way by assigning marks, of which, of course, there was a maximum. The objections which he urged against the socialists of the day were that they failed to realise the importance and necessity of capital, the difficulty of handling capital, and the high qualities of mind which are necessary to foresee changes in supply and demand if big businesses are to be conducted. Likewise he dreaded the dead level of individuality which socialism of the Bellamy type would produce.

Above all, William Sutherland was an Australian, passionately fond of his country and his countrymen. The rise of Australian art that was to interpret to the world the appeal of Australian landscape, the wonderful light and atmospheric effects by bush, river and sea inlet, and the perfect beauty of line in the Australian tree he watched with unbounded satisfaction, and gave what encouragement was in his power. He believed that in music the Australian would one day find a great outlet for his æsthetic strivings. But, whether it was in art or in science, commerce or statesmanship, he knew that the Australian qualities of initiative and steadfastness, of

candour and justice, would assuredly tell in the world's story. As yet there was no Villers Brettonneux to make the world think this likely.

CHAPTER VI.

The Scientific Achievement.

THE first appearance of the name William Sutherland in scientific literature occurs at the head of a mathematical paper—Mechanical Integration of the Product of Two Functions—in the "Philosophical Magazine," in August, 1885. But half a year afterwards we find him giving for the same problem a much simpler solution, which had been suggested to him by Professor Nanson, of Melbourne. The first real contribution to science is his next or third paper in the "Philosophical Magazine," of August, 1886, entitled The Law of Attraction Amongst the Molecules of a Gas. This paper represents a very solid piece of work to be carried out alone by a young man of twenty seven; and it is interesting, too, for the fact that it shows the strong bent towards molecular physics, which its author maintained throughout his life.

Moreover, one may find in it the key to practically the whole fabric of research, which, in subsequent years, he was to elaborate. Starting from the well-known experiments of Thomson and Joule on the cooling effect in gases escaping from a higher to a lower pressure through a porous plug, Sutherland deduced that the units or molecules of a gas attract one another with a force inversely proportional to the fourth power of the distance between them, and directly proportional to the product of their masses. Though subsequent research led to a modification of the idea of direct proportionality with the product of the masses, yet the other and important relationship,—that of the inverse fourth power of the distance—has been widely accepted, though it ran counter to the authority of Kelvin. A year later, further calculations were published on the same law, which was now extended to liquids. A more daring extension was to apply the kinetic theory to solids; that is to say, the molecules have the properties assigned to them in the kinetic theory of gases, each moving in a small region of space round a certain mean position. He complained that hitherto the theory of solids was purely static and made the challenging

assertion that, on static principles, rigidity, as it exists, could not be conceived. Indications of the many vistas of research opening up begin to appear—the theory of elasticity, chemical affinity, capillary action—possibly all the actions of matter on matter can be realised as attractions.

And now Sutherland set himself to attack the problems which the properties of matter display, armed with this new weapon of research. The first to come under review was surface tension, and a tentative explanation was given of the empiric law describing the relation between surface tension, molecular volume and alteration of temperature. Of course, in his systematic analysis of the properties of matter, other problems not directly connected with the central thesis would start up, and once scientific curiosity was aroused no peace could be experienced until a solution was in view. Such were his researches at this stage on molecular refraction, and a new periodic property of the elements, the latter establishing the fact that the periods of vibration of the molecules of solids at their melting points show very simple harmonic relations, and allow us to group the elements

in the well-known arrangement according to the Periodic Law.

In the "Philosophical Magazine" of December, 1893, appeared the paper on the viscosity of gases, by which the name of William Sutherland is best known to physicists. In 1860 Clerk Maxwell had announced that if the kinetic theory of gases was correct, then the viscosity ought to be independent of the pressure. That is to say, a pendulum would be just as much damped in its movement by gaseous friction in an environment under one-twentieth of an atmosphere, as under twenty atmospheres. Experiments in gases from high down to fairly low pressures demonstrated the correctness of his reasoning. But in establishing the relation between viscosity and temperature Clerk Maxwell had not the same success. According to the existing theory the viscosity should vary as the square root of the absolute temperature. Experimental investigation, however, showed that this was not the case. Clerk Maxwell, after an unsuccessful attempt to explain some inaccurate data by assuming a repulsive force between molecules, left the problem unsolved. O. E. Meyer tried to get over the difficulty by postulating that molecules shrink as the

temperature rises, but calculation showed that the shrinkage would have to be of an order very obvious in other properties, and this is not so. Sutherland now attacked the problem. Applying his inverse fourth power law he demonstrated that molecules, which would otherwise pass close to each other without collision, would, if attraction existed, actually meet. Hitherto in the kinetic theory of gases the path of each molecule was supposed to be a straight line between collision and collision. But now Sutherland, with something of an astronomer's vision, pictured the molecules in their flight being deflected under the pull of mutual attraction, and arrived at his well-known equation:—

$$\eta_t = \eta_0 \frac{273 + C}{\theta + C} \cdot \left(\frac{\theta}{273}\right)^{\frac{3}{2}},$$

where θ is the absolute temperature and C is a constant, now referred to as Sutherland's constant. Whatever criticism may have been levelled by physicists at the theoretical analysis there has been no hesitation in accepting the result, for the formula holds for all temperatures above the critical and over the wide range of pressures in which Boyle's Law is approximately obeyed.

THE SCIENTIFIC ACHIEVEMENT

The papers published in the following two years (1894 and 1895) carry the investigation of molecular attraction into mixtures of unlike molecules using data of diffusion for gases and of surface tension for mixed liquids. The surface tension of aqueous solution was shown to follow the same law as mixed liquids. It was further demonstrated that a certain mathematical expression used in setting out the attractions of like molecules could be deduced from the properties of the constituent atoms, and therefore indicating that molecular attraction could be analysed into atomic. It was here that the disturbance due to valency first came within his view, leading step by step in later years to his theory of electric doublets. In the meantime it led to a review of thermochemical literature, and a discovery was made, the importance of which was not realised at the time. The heat of formation of a compound R S was separated into three parts: (R), (S), and f (RS). (R) depends entirely on R, (S) on S, while f (RS) depends upon both R and S. In calculating out f (RS) for different compounds, Sutherland was surprised to find that the figures were all multiples of 3.8. "There is, therefore," he

writes* "rather strong evidence for the hypothesis that atoms, in combining chemically with one another, give forth integral numbers of a certain unit of heat, which may be called the atomic thermochemical unit." In the light of recent developments in physics this is rather an interesting conclusion.

After this came an excursion into the subject of gases at low pressures. The theory of the radiometer was attacked anew, and this may be said to have resulted in an assurance that the kinetic theory of gases accounts for all the phenomena manifested by the instrument. Two suggestions were also made for the making of pressure gauges for very low pressures, one a torsion radiometer and the other a simple viscosity measurement by means of a suspended and oscillating disk. I believe these suggestions have been put into operation in America, though the practical difficulties are greater than Sutherland imagined.

In connection with this work on rarified gases a disturbing fact was announced by the experimentalists, namely, that in very low pressures Boyle's Law (pressure of gas multiplied

*"Phil. Mag.," vol. 40, July, 1895, p. 55.

by volume equals a constant) does not hold. This had to be looked into, for in theory rarefaction ought to make a gas follow Boyle's Law better than when compressed. The possible influence of attraction by the walls of the containing vessel was examined and rejected. The conclusion was reached that water vapour, held by the glass wall of the apparatus under ordinary pressures, but given off into high vacua, accounted for a good deal. Also there was the possibility of dissociation of molecules or even association at these low pressures. That association, paradoxical as it may seem, could occur was shown to be the case with oxygen O_2, which forms ozone O_3 when rarified. As the pressure rises there is a critical pressure at which the number of collisions which the ozone molecule sustains breaks it up into the smaller oxygen or O_2.

A pleasant interlude occurred in the midst of these researches. A holiday by the seaside set the active mind thinking what the phenomenon of "ducks and drakes," the delight of small children who have access to smooth water and flat stones, really implies. The result was a paper entitled "High Tensions in

Moving Liquids."* His explanation is now an accepted commonplace in physical text-books.

Research in molecular physics was dropped for a brief spell in order to look into the famous Michelson Morley experiment. If light is a disturbance propagated through a medium "æther" and if the earth in its passage through space slips through the æther without affecting that medium, then the velocity of light as measured on the earth's surface ought to vary according to the direction of the beam measured, whether in the same direction as, or the opposite direction to, or making an angle with the line of travel of that part of the earth. But the Michelson Morley experiment showed that the velocity of light was the same irrespective of the direction of the light. Does the earth then carry a shell of æther with it in its flight? The experiments of Sir Oliver Lodge with great steel disks said plainly no. Perhaps there is no æther—perhaps—? This great experiment, which has been the begetter of some of the most recondite speculations in physics disturbed Sutherland very much. Often in con-

*"Phil. Mag.," vol. 42, July, 1896, p. 111.

versation he came back to it. While he admired the ingenuity of the Fitzgerald-Lorentz explanation—namely, that matter alters in dimensions when in motion owing to its static charges becoming to all intents and purposes currents, and capable of forming magnetic fields, and that, in consequence, the base line of the Michelson Morley experiment altered in length in a manner that exactly compensated for the altered velocity of light—his instinct somehow warned him that greater issues were at stake. So he strove to find a flaw in the technique. He believed he succeeded in showing that the capability of interference fringes to measure minute lengths, had been overrated to an unknown extent. The argument is difficult to follow, but the general opinion at present amongst those competent to give a verdict is that his criticism was not sound.

In 1900 appeared the first of the papers on the constitution of water, the last being published in 1910 in the Transactions of the Faraday Society. Water, the most prevalent fluid, and the most familiar, is, in its properties, the most anomalous. With most chemists the formula H_2O suffices; it tells that a molecule of water is composed of two atoms of hydro-

gen and one of oxygen. But to the physicist this constitution appears impossible, for theory shows that the boiling point and freezing point would not be so far apart on the scale, and would be much lower, —100 and —150 degrees Centigrade, in fact, instead of + 100 and 0 degrees. Then there is the peculiar and well-known behaviour close to the freezing point when the liquid expands as it cools, and the equally strange, though less familiar changes that occur in viscosity and compressibility. The specific heat of water is also higher than the simple constitution represented by H_2O would allow—moreover it varies with the temperature. These and other considerations led physicists to assume that water contained polymers of H_2O, that is, molecules composed of two or more H_2O units bound together. In 1892 Röntgen had suggested that water contained ice in solution. From this idea Sutherland started out and by mathematical treatment of the mass of known data concerning water deduced that steam is H_2O or hydrol, as he named it, whilst ice is trihydrol, or $(H_2O)_3$. These conclusions and his nomenclature have been adopted by physicists. Difficulties have arisen over his hypothesis that liquid water is a solution of tri-

hydrol $(H_2O)_3$ in dihydrol $(H_2O)_2$ the amount varying with the temperature. At present the more accepted view is that hydrol H_2O is also present in liquid water, which is therefore a system of three components all varying in relative amount with the temperature.

In the same year, 1900, appeared also the first of three papers on the cause of the earth's magnetism, which was ascribed to the earth carrying round an electrostatic field in its rotation, for, as had been shown by Rowland, a moving charge of electricity produces a magnetic field analogous to that of a current. Of the exact nature of the electrostatic charge, Sutherland put forward different views in his different papers, at first it was ozone in the upper air, then it was the electric charges which condition valency, and lastly it was found in the opposing electric doublets which constitute matter, one set, the negative, being further from the centre of the earth, i.e., acted on by gravity less than the positive. On this hypothesis the suggestion of Kelvin would be correct that magnetism is a property of rotating masses which becomes measureable only when the masses are large enough. In 1901 only one scientific paper saw the light of publication, but it embodies one of the most dar-

ing speculations which Sutherland's mind conceived. This was an attempt to establish a causal relationship between the rigidity of an element and its spectrum.

"The structure of spectra is traced to two facts, first, that atoms vibrate as deformable, but practically incompressible bodies of finite calculable rigidity, so that their surfaces have stationary waves corresponding to the fundamental mode of vibration and its harmonics; and second, that electrons, in describing nearly circular orbits round an atom, out of an infinity of such orbits possible, have orbits of certain frequencies made predominant by resonance. . . . The orbits for a positive electron are different from those for a negative, and therefore a relative motion between positive and negative electron is set up. This is the direct cause of the vibrations of light. This relative motion can be represented by giving the positive and negative electron different angular velocities round the circumference of a circle. . . .

"From the rigidities of the metals at absolute zero the mechanical periods of vibration of the atoms are calculated and proved to exhibit simple harmonic relations, and probably to possess a common harmonic of a frequency

of the same order as that of ordinary light. It is probable that the common harmonic of the atoms and the fundamental mode of motion of the electron are identical or harmonically related. The spectra of different elements thus appear to be caused by practically one and the same form of electrical appliance (pair of electrons)."*

In 1910 he returned to the same subject in a brief paper. Though there is no real distinction between mechanical and electrical vibrations of atoms, yet the distinction is convenient. Now, the period of vibration of the extreme infra-red is about the order of magnitude of the mechancial vibration of atoms and molecules. New data on the infra-red spectra supported his general conclusions as to the relationship between rigidity and spectral features, and also that the spectrum of a molecule can be deduced from the spectral qualities of its constituent atoms.

Greater things were still to be accomplished. The "Philosophical Magazine" of February, 1902, contained his paper on Ionisation, Ionic Velocities and Atomic Sizes. Here suddenly

*"Phil. Mag.," S. 6. Vol. 2. Sept., 1901, p. 274.

bursts out the electric doublet hypothesis, which was to dominate the remaining nine years of his life. Starting from Faraday and Helmholtz he conceived that the atom contained one or more doublets or groups of two oppositely charged electric units. Valency had already been ascribed to unopposed or uncoupled charges, a single chemical bond in an atom corresponding to one uncoupled electron and so forth. This is the first paper in which use was made of the musical types ♯ and ♭ for the + and — employed by physicists in dealing with electric charges. The frequent occurrences of these in many of his papers from this time on has given a somewhat bizarre appearance to the pages and has no doubt frightened away many a prospective reader who adheres more to convention. The biographer may, with diffidence, suggest that it is a pity men of science have not adopted this idea. The use of + and — is admittedly illogical, whereas the musical symbols have no misleading mathematical associations, and moreover are found in every printer's sets of type. Having got hold of this idea of electric doublets, Sutherland proceeded in a series of profound researches to establish the fact that the properties of matter were electric in

origin. The attraction of molecules is an attraction between doublets. Rigidity, elasticity, viscosity, ionisation, dielectric capacity and spectral character were separately considered, and the same fundamental and unifying idea applied.

"Sutherland assigned to each atom a specific attracting power. He regarded an atom of hydrogen, for instance, as exerting a certain force on another atom. The law of this force (that is to say, its variation with the distance between the atoms) was, he held, the same for all atoms, but its magnitude depended on a specific constant, different for each element, hence there was one value for an atom of hydrogen, and a different value for an atom of oxygen and so on. Sutherland sought to determine the value of these constants through certain hypotheses as to the nature of the forces exerted. He assumed that each atom contained both a positive and a negative charge, but that the negative charge was not in quite the same position as the positive one. There was thus a residual external field, each atom resembling a little magnet with its positive and negative poles. . . . The moment of this doublet (that is to say, the product of either charge by the dis-

tance between the two charges) was, in Sutherland's view, characteristic of any particular atom. Sutherland calculated out the value of these moments for various elements, basing his calculations on the principle that if atoms did exert force on each other, it would be necessary to do a certain amount of work to remove an atom from a mass of many others, and that this work would depend upon the magnitude of the forces involved. Sutherland succeeded in finding an expression for this work in terms of the moments of his electric doublets."*

It would be impossible, in a biography of this scope, to give individual attention to these different researches. In the future the task one hopes may be undertaken of presenting Sutherland's conclusions in a more assimilable form than his own. But there is no question that his conception of the electric doublet with the large number of properties of matter which it can explain, is to be reckoned as his greatest contribution to science.

Other scientific interests found place in his

*Report of lecture at the Royal Institution by Sir J. J. Thomson, O.M., F.R.S., in Engineering, 6th March, 1914, p. 323.

mind in the last years of his life. The size of molecules, including albumen "molecules," was deduced from the velocity of diffusion and by electric conductivity. The enthusiastic work of the school of physical chemists could not fail to excite his interest, but, like Kelvin and Helmholtz, he was somewhat critical of their assumptions. The theory of solutions held by the physical chemists lacked, according to him, a dynamical foundation. When an electrolyte is dissolved in water it is assumed that a certain fraction of the total number of molecules is dissociated into ions, the degree of dissociation representing an equilibrium between dissociated and non-dissociated, and controlled by the laws of mass action. Sutherland objected, on general grounds, and also on account of the experimental departure from the law of mass action found in concentrated solutions. His proposal was decidedly novel, namely, that ionisation is complete in solutions of all concentrations. "The ionising action of the solvent is so powerful that it holds the tendency of the ions to recombine quite in check, notwithstanding the strong electric attractions between them. But these electric forces introduce two sorts of viscous resistance which

make the mobility of the ions a function of their concentration. This change of mobility is what the prevalent theory interprets as change of degree of ionisation in strong electrolytes."*

This, to physical chemists, subversive idea has received but little attention from them, and that little not complimentary. Further and competent investigation will demonstrate what value it possesses.

In the last year of his life he turned his attention to the composition of protein and gave biochemists the useful idea of a three dimensional pattern or "semplar" as the basic concept of the protein molecule or unit. In physiology he tried his hand with an hypothesis of nerve action, tracing the impulse to the propagation of a shear in a gel cylinder. About the last paper to appear from his pen was concerned with the spiral structure of nebulæ and the origin of the ratios of planetary distances from the sun. Though not contributing to the discussion on relativity there is no doubt that he was agitated by this new doctrine. The Michelson Morley experiment, as has been said, perplexed him very much.

*"Phil. Mag.," S. 6. Vol. 21, p. 18.

Though he hesitated to follow Einstein into the semi-metaphysical treatment of space and time he recognised the magnitude of the new ideas that were gaining ground amongst physicists. Perhaps his attitude can best be put in this form, that he did not like the conception of relativity, but would not pronounce that it was not going to do something big. With the professors of physics in Sydney, Professor Threlfall, and afterwards Professor Pollock, and with Professor Bragg in Adelaide, he kept up a lively correspondence on their respective researches. The letters written by these gentlemen he carefully preserved, and reference to them in conversation made it easy to surmise that their tone and contents gave him pleasure.

What, it may be asked, does the sum total of William Sutherland's contribution to science amount to? That assessment cannot as yet be made. Had he taken the advice of several men of science, including Lord Rayleigh, and assembled and remodelled his conclusions in book form, the valuation would be less difficult, though still far from simple. As science moves on, certain of his speculations will doubtless be rendered sterile, but it is also possible that many paths which he de-

signed and worked singlehanded will be reopened and followed. To use his own simile, the man of science resembles the orchardist—time must pass before the fruit appears. As has been explained, a good deal is already firmly established in the science of natural philosophy. But whatever be the verdict of posterity on the total value of the achievement, there remain the effort, the dedication, and the sacrifice constituting an example that should appeal to the youth of his own and every other land.

CHAPTER VII.

The Man.

THE writer of this biography first met William Sutherland on a Sunday evening in 1904, at the hospitable house of Dr. (now Sir James) Barrett. The brown, tanned skin of face and hands, and a certain simplicity of cut in the clothes led me (not having caught the name) to the opinion that I was regarding an agriculturalist. The conversation at the time was with the professor of music, the late Professor Marshall Hall, but the "agriculturalist" soon got into a lively argument with the man of music, and showed such a wealth of detailed technical knowledge of Wagnerian orchestration, and held his own with such ease that there was apparently only one opinion possible—he was a professional musician. Others joined the group, and the conversation changed to Mark Twain, and from that to American humourists. Here my fellow-guest was perfectly at

home; the special qualities of Bill Nye, Eugene Field, Josh Billings of course, and others more modern than these, and whose names were unfamiliar, were lightly touched upon and gracefully presented. I think it was our host who then introduced a question in economics and referred to his versatile guest for support. A little bewildered, I happened soon to find myself alone with William Sutherland (still unnamed to me) and managed to get the conversation on scientific subjects. Here he was all attention, and listened appreciatively to some laboratory gossip that I had just brought from London. I asked if he was interested in science. His reply was a simple yes, and then a quiet statement that he had just published a paper, and would be pleased to send me a reprint. Next morning it arrived by post, and in place of the amateur production which I fear I expected there confronted me a reprint from the Boltzmann-Festschrift, entitled The Principle of Dynamical Similarity in Molecular Physics! Sutherland's catholicity of taste in reading and his possession of a very receptive and tenacious memory made his knowledge encyclopædic. Once only did we see him discomfited. A lady, who was a science graduate, somewhat sceptical of a

weather glass in which coming meteorological events are supposed to be forecasted by the deposition of crystals in a fluid, asked what were the contents of this tube, and on what principle it worked. The animated features suddenly became perplexed, a slight tremor of the lower lip, to which he was occasionally subject, showed itself; then, with a deep blush of shame came the confession—he did not know! To his wide knowledge there was added a well balanced judgment and great gentleness in criticism. Once only did the writer hear a sarcastic comment. A certain Bishop X was lecturing on Theology, Evolution and Science, etc. When asked if he had read the reports of these lectures Sutherland replied very quietly:—"I am just aware, from certain references in the papers, that there is such a person as Bishop X." Possibly his one view, which might be considered extreme, was his antagonism to the teaching of Latin and Greek in the schools. He had no racial animosity of any kind, and the idea of war between Britain and Germany was to him too horrible to contemplate. "They must learn to respect each other's strength," he would often say. In politics he took a broad democratic view, being opposed to privilege of all

forms, and most sympathetic towards equalisation of opportunity for all. He was not a socialist, however, for reasons already given, nor did he care to see State interference override personal initiative. In the matter of education, for instance, he supported in the press the wider extension of State school education, primary and secondary, but was opposed to any organisation that robbed the private secondary schools (public schools in the English sense) of their individuality. Any loss of liberty in a university and any introduction there of bureaucratic control would, in his view, mean the early extinction of that university as a leader in thought.

He was sometimes spoken of as a little unsocial. There was certainly some shyness and reserve, but once that wore off he was boyish in his comradeship. Then, too, living with brothers and sisters, all interested and all proficient in literature, or art, or philosophy, he found conversation in other circles less attractive, if not too often insipid. Once or twice to his sisters he hinted that he might have been a little more social—the only instance of repining known—for, as regards his choice of a small income, but great freedom, he felt no regrets; he had chosen the better

part. His immense store of knowledge certainly aroused the wonder of his friends; for his sane judgment they had due appreciation, but what gained their respect was the punctilious veracity and unstainable honour of the man. William Sutherland, whatever he could do, could not swerve a hair's breadth from the truth.

As has been remarked, he gloried in the Australian bush. There could be no finer holiday than to take a "billy" and some simple food and tramp over the ranges and through the tremendous forests. He retained happy memories of some long walks, accompanied by Professor C. J. Martin, now Director of the Lister Institute, London, in whom he found a congenial companion. The writer was fortunate in having many visits from him in his country home at Warrandyte, where the bush land envelopes the Yarra valley. There would be heard a loud coo-ee, and Sutherland would be seen climbing briskly over the fence. He rarely used roads or gates in these walks, but in true Australian fashion, would strike across gullies, bush land and paddocks on a line of his own, irrespective of fencing or freehold rights.

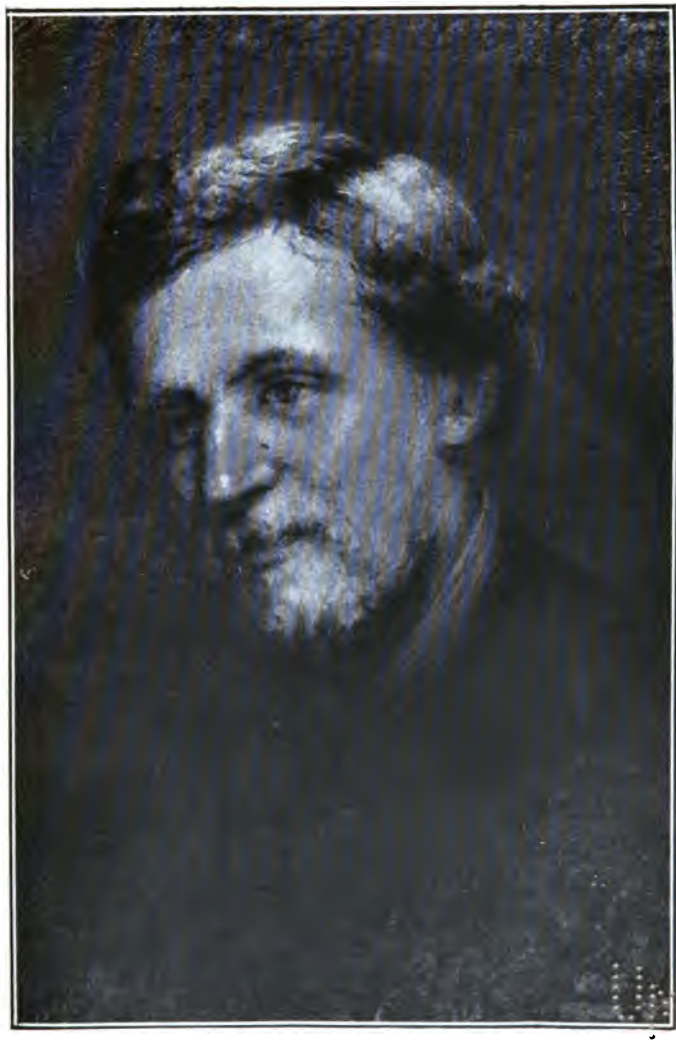
He had a keen sense of humour and the

merry twinkle of his eyes would announce the detection of an incongruity often before it was obvious to others.

A fine element in his character was his fondness of children, with whom he speedily got on good terms. He did not marry. Once when an intimate friend told him, half in jest, but half seriously, that it was his duty to transmit his powers to progeny, a look of profound sadness passed over his face. What recollection or resolve had been awakened we shall not know.

He was a little below average stature, but broad shouldered. The face had a certain suggestion of the physicist Tyndall. The complexion, owing to his daily exposure to the Australian sun, was generally brown, but sometimes, especially after a spell of examining in sultry weather, it was pallid. There were some remnants of scars on his face, but not disfiguring, as the result of a bad fall from a bicycle. He walked quickly with an elastic step. He could swim with confidence. He never indulged in tobacco or alcohol, and lived a sound, happy, wholesome and blameless life.

He always regarded himself as a strong man, and on occasions could undertake long



William Sutherland in the last year of his life
(From a pastel by his sister, Miss Jane Sutherland)

journeys on foot. Once, indeed, when the snow lay deep on the ranges, his endurance saved him from a quite possible catastrophe. But his medical friends, who could see an advancing hardening of the arteries, knew that the doom which had already overtaken two of his brothers was, alas, not destined to pass him over. When a boy he had suffered from a temporary paralysis of the facial nerve on one side, which a doctor diagnosed, unfortunately for the boy's peace of mind, as a cerebral lesion; but a consultant ascribed it to a local chill. Apart from this his life was spent without obvious illness, though in the last year of his life he often looked jaded. On the morning of the 5th of October, 1911, his youngest sister, finding that he was not up and about as usual, knocked at his bedroom door. There was no response. She entered, and found her brother with his hand still warm lying peacefully in the eternal sleep. Rupture of the wall of the heart ventricle had occurred at some hour of the night. At the early age of fifty-two, therefore, and at the height of his intellectual powers, he passed away.

Science, we all know, has had her martyrs. What we should realise with equal conviction,

is that she has had her saints. And amongst the saints of science high place will assuredly be found for William Sutherland.

The End.

APPENDIX.

Contributions to Scientific Literature.

By William Sutherland.

(*The corrections are those found in his own copies of the publications.*)

(1) Mechanical Integration of the Product of two Functions. Phil. Mag. S.5, Vol. 20, 1885, p. 175.

(2) Mechanical Integration of the Product of two Functions. Phil. Mag. S.5, Vol. 21, 1886, p. 141.

(3) The Law of Attraction amongst the Molecules of a Gas. Phil. Mag. S.5, Vol. 22, 1886, p. 81.

(4) On the Law of Molecular Force. Phil. Mag. S.5, Vol. 24, 1887, p. 113.

(5) On the Law of Molecular Force. Phil. Mag. S.5, Vol. 24, 1887, p. 168.

(6) On the Law of Molecular Force. Report of the First Meeting of the Australasian Association for the Advancement of Science held at Sydney, 1888, p. 39.

(7) Molecular Refraction. Report First Meeting Australasian Assoc. Adv. Science, 1888, p. 42.

(8) On the Recalculation of certain Specific Heats at High Temperatures, and the Specific Heat of Water. Phil. Mag. S.5, Vol. 26, 1888, p. 298.

(9) Molecular Refraction. Phil. Mag. S.5, Vol. 27, 1889, p. 141.

Corrigendum.—P. 149, line 16, for $(N^2-1)(N^2+2)$ read $(N^2-1)/(N^2+2)$.

(10) On the Law of Molecular Force. Phil. Mag. S.5, Vol. 27, 1889, p. 305.

(11) A new Periodic Property of the Elements. Phil. Mag. S.5, Vol. 30, 1890, p. 318.

(12) A Kinetic Theory of Solids, with an experimental Introduction. Phil. Mag. S.5, Vol. 32, 1891, p. 31.

(13) The Laws of Molecular Force. Phil. Mag. S.5, Vol. 35, 1893, p. 211.

Corrigenda.—pp. 234, 235, and 236, Section 5 to be cancelled. See also next paper.

P. 281, last line but one—the bracket should be completed excluding RvT.

(14) Some Corrections to a Paper on the Laws of Molecular Force. Phil. Mag. S.5, Vol. 36, 1893, p. 150.

(15) The Viscosity of Gases and Molecular Force. Phil. Mag. S.5, Vol. 36, 1893, p. 507.

(16) The Attraction of Unlike Molecules. I. The Diffusion of Gases. Phil. Mag. S.5, Vol. 38, 1894, p. 1.

Corrigendum.—p. 7, line 22, for 1.5 read 15.

(17) The Attraction of Unlike Molecules. II. The Surface Tension of Mixed Liquids. Phil. Mag. S.5, Vol. 38, 1894, p. 188.

(18) Further Studies on Molecular Force. Phil. Mag. S.5, Vol. 39, 1895, p. 1.

(19) The Fundamental Laws of Thermochemistry. Phil. Mag. S.5, Vol. 40, 1895, p. 1.

(20) The Viscosity of Mixed Gases. Phil. Mag. S.5, Vol. 40, 1895, p. 421.

(21) Molecular Force and the Surface Tension of Solutions. Phil. Mag. S.5, Vol. 40, 1895, p. 477.

(22) High Tensions in Moving Liquids. Phil. Mag. S.5, Vol. 42, 1896, p. 111.

APPENDIX

(23) Thermal Transpiration and Radiometer Motion. Phil. Mag. S.5, Vol. 42, 1896, p. 373.

(24) Thermal Transpiration and Radiometer Motion. Phil. Mag. S.5, Vol. 42, 1896, p. 476.

(25) Boyle's Law at very Low Pressures. Phil. Mag. S.5, Vol. 43, 1897, p. 11.

(26) Two New Pressure-Gauges for the Highest Vacua. Phil. Mag. S.5, Vol. 43, 1897, p. 83.

(27) The Spontaneous Change of Oxygen into Ozone and a Remarkable Type of Dissociation. Phil. Mag. S.5, Vol. 43, 1897, p. 201.

(28) Thermal Transpiration and Radiometer Motion. Phil. Mag. S.5, Vol. 44, 1897, p. 52.

(29) The Causes of Osmotic Pressure and of the Simplicity of the Laws of Dilute Solutions. Phil. Mag. S.5, Vol. 44, 1897, p. 493.

(30) Relative Motion of the Earth and Aether. Phil. Mag. S.5, Vol. 45, 1898, p. 23.

(31) Latent Heat of Evaporation of Zinc and Cadmium. Phil. Mag. S.5, Vol. 46, 1898, p. 345.

(32) Relative Motion of the Earth and Aether. Phil. Mag. S.5, Vol. 47, 1899, p. 252.

(33) Cathode, Lenard, and Röntgen Rays. Phil. Mag. S.5, Vol. 47, 1899, p. 269.

(34) A Possible Cause of the Earth's Magnetism and a Theory of its Variations. Terrestrial Magnetism and Atmospheric Electricity, June, 1900, p. 73.

(35) The Molecular Constitution of Water. Phil. Mag. S.5, Vol. 50, 1900, p. 460.

(36) The Cause of the Structure of Spectra. Phil. Mag. S.6, Vol. 2, 1901, p. 245.

(37) Ionization, Ionic Velocities and Atomic Sizes. Phil. Mag. S.6, Vol. 3, 1902, p. 161.

APPENDIX

(38) The Electric Origin of Molecular Attraction. Phil. Mag. S.6, Vol. 4, 1902, p. 625.

(39 Das Elasticitätsmodul von Metallen bei niedrigen Temperaturen. Annalen der Physik. Vierte Folge, Band 8, s. 474.

(40) The Cause of the Earth's Magnetism. Terrestrial Magnetism and Atmospheric Electricity, June, 1903, p. 49.

(41) The Measurement of Large Molecular Masses. Trans. Austrn. Assoc. Advanct. of Science. Dunedin, January, 1904, p. 117.

Corrigendum.

P. 119, for $D = \frac{RT}{6 \Pi \eta a}$ read $D = \frac{RT}{6 \Pi \eta a C}$

where C is the number of molecules in a gramme molecule.

(42) The Dielectric Capacity of Atoms. Phil. Mag. S.6, Vol. 7, 1904, p. 402.

(43) The Crémieu-Pender Discovery. Phil. Mag. S.6, Vol. 7, 1904, p. 405.

(44) The Electric Origin of Rigidity and Consequences. Phil. Mag. S.6, Vol. 7, 1904, p. 417.

(45) The Electric Origin of Gravitation and Terrestrial Magnetism. Phil. Mag. S.6, Vol. 8, 1904, p. 685.

(46) The Principle of Dynamical Similarity in Molecular Physics. Boltzmann-Festschrift. 1904, p. 373.

(47) On the Cause of the Earth's Magnetism and Gravitation. Terrest. Mag. and Atmos. Elect., Dec., 1904, p. 167.

APPENDIX

Corrigenda.—P. 167, line 9, for *Thompson* read *Thomson.*

P. 171, line 25, for $V^2 + v^2$ read $V^2 + V^2$.

(48) A Dynamical Theory of Diffusion for Non-Electrolytes and the Molecular Mass of Albumen. Phil. Mag. S.6, Vol. 9, 1905, p. 781.

(49) The Nature of the Propagation of Nerve Impulse. American Journal of Physiology, Vol. 14, 1905, p. 112.

(50) The Molecular Constitution of Aqueous Solutions. Phil. Mag. S.6, Vol. 12, 1906. p. 1.

(51) The Nature of Chemical and Electrical Stimulation. Americ. J. Physiol., Vol. 17, 1906, p. 266.

(52) A Molecular Theory of the Electric Properties of Nerve. Americ. J. Physiol., Vol. 17, 1906, p. 297.

Corrigenda.—P. 298. Third line from bottom for 1000p. read 1000w. P. 299 ,line 1 and line 10, the same correction.

(53) Ionization in Solutions and Two New Types of Viscosity. Phil. Mag. S.6, Vol. 14, 1907, p. 1.

(54) The Chemistry of Globulin. Proc. Roy. Soc. B., Vol. 79, 1907, p. 130.

(55) Another Method of Measuring Large Molecular Masses. Phil. Mag. S.6, Vol. 16, 1908, p. 497.

(56) The Nature of the Conduction of the Nerve Impulse. Americ. J. Physiol., Vol. 23, 1908, p. 115.

(57) Solar Magnetic Fields and the Cause of Terrestrial Magnetism. Terrest. Magnt. and Atmos. Elect., December, 1908, p. 155.

(58) Molecular Diameters. Phil. Mag. S.6, Vol. 17, 1909, p. 320.

(59) The Electric Origin of Molecular Attraction. Phil. Mag. S.6, Vol. 17, 1909, p. 657.

APPENDIX

(60) The Ions of Gases. Phil. Mag. S.6, Vol. 18, 1909, p. 341.

(61) The Fundamental Constant of Atomic Vibration and the Nature of Dielectric Capacity. Phil. Mag. S.6, Vol. 19, 1910, p. 1.

(62) Molecular Diameters. Phil. Mag. S.6, Vol. 19, 1910, p. 25.

(63) The Constitution of Water. Transactions Faraday Society, Vol. VI., Pt. I., July, 1910.

(64) The Theory of the Small Ion in Gases. Phil. Mag. S.6, Vol. 19, 1910, p. 817.

(65) Molecular and Electronic Potential Energy. Phil. Mag. S.6, Vol. 20, 1910, p. 249.

(66) The Mechanical Vibration of Atoms. Phil. Mag. S.6, Vol. 20, 1910, p. 657.

(67) The "heat coagulation" of protein. Proc. Physiol. Soc., Jan. 21, 1911, in Journal of Physiology, Vol. 42.

(68) On Weak Electrolytes and towards a Dynamical Theory of Solution. Phil. Mag. S.6, Vol. 21, 1911, p. 17.

(69) Bode's Law and Spiral Structure in Nebulae. Astrophysical Journal, Vol. 34, 1911, p. 251.

The Specialty Press Pty. Ltd. 174-176 Little Collins Street, Melbourne

Lothian's Catalogue
of
All-Australian Books

AUTHORS

Abramowski, Dr. O. L. M.
Barrett, Charles.
Brady, Edwin J.
Brereton, M.A., J. Le Gay.
Carmichael, J.
Church, H.
Cassidy, R. J.
Derham, M.A., E.
Esson, L.
Enright, Rev. John.
Edquist, A. G.
Fleming, M.H.R., W. M.
Furphy, Joseph.
Gordon, A. L.
Grahame, Edith.
"Gossip."
Gay, William.
Holman, W. C.
Hart, Fritz.
Hall, D.Sc., T. S.
Hoy, M. A. A.
Jamieson, W. R.
Kendall, Henry C.
Lawson, Henry.
Murdoch, M.A., Prof. Walter.
Marshall, I. D.
Mackay, Jessie.
McCubbin, Frederick.
McCrae, Hugh.
McGuffin, William.
Osborne, Prof. W. A.
O'Dowd, Bernard.
Onians, Edith C.
Outhwaite, Ida R.
Paterson, Prof. John W.
Quin, Tarella.
Rentoul, Annie.
Rainbow, W. J.
Sargant, George.
Strong, M.A., Archibald T.
Tucker, M.A., T. G.
Tonge, M.A., A. W.
Tate, M.A., C.M.G., Frank
Wollaston, T. C.
Watson, Kathleen.
Wallace, M.A., Prof. R. S.
Williamson, F. S.
Williams, M.A., W. H.

The Lothian Book Publishing Co. Pty. Ltd.
The Rialto, 497 Collins Street, Melbourne
Founded 1905

THE SPIRIT OF THE CHILD. By **T. C. Wollaston.** Illustrated with four coloured plates and numerous half-tone pictures. 2nd thousand. Price, 5s. (4d.).

This is a book for thoughtful minds and joyous hearts. It brings joy. It is a life-philosophy, founded on that rare love of beauty which the author holds; it is the mainspring of both humility and gratitude.

It is for everybody who wishes to give back to the world, and pass on to struggling lives, some of the precious things received from the reservoir of God's bounty.

To make this book your own in the double sense will be to bring a new spirit into the trivial round and common task, and to live in the upper air.

PLATFORM MONOLOGUES. By **T. G. Tucker, Litt. D. (Camb.); Hon. Litt. D. (Dublin).** Cloth, 3s. 6d. (3d.).

I. Preface. II. The Supreme Literary Gift. III. Hebraism and Hellenism. IV. The Principles of Criticism applied to Two Successors of Tennyson. V. The Making of a Shakespeare. VI. The Future of Poetry.

THINGS WORTH THINKING ABOUT. A series of Lectures upon Literature and Culture. By **T. G. Tucker, Litt. D. (Camb.).** Price, 3s. 6d. (3d.).

SAPPHO. By **T. G. Tucker, Litt. D. (Camb.); Hon. Litt. D. (Dublin).** A Lecture which throws fresh illumination on a wonderful figure, and contains a full translation of all the authentic passages. Cloth, 2s. 6d. (3d.).

LITANIES OF LIFE. By **Kathleen Watson,** author of "The House of Broken Dreams," "The Gaiety of Fatma." 5th edition. Crown 8vo.; bound in full cloth, gold blocked. Price, 2s. 6d. (2d.).

"Little studies of life—tragi-comedies of human existence."—*Bookseller.*

LATER LITANIES. By **Kathleen Watson.** Full cloth, gilt, 2s. 6d. (2d.).

I. The Small Brown Room (a sequel to "The House of Broken Dreams"). II. Ursula. III. If Love but Knew. IV. An Unposted Letter.

THE HOUSE OF BROKEN DREAMS: A Memory. By **Kathleen Watson.** 2nd edition. Crown 8vo.; bound in full cloth. Price, 2s. 6d. (2d.).

Written with the same quiet command of language and the same ineffable pathos as the "Litanies."

THE ISLE OF PALMS. By **Charles Barrett.** Cloth; well illustrated, frontispiece in colour by Charles Nuttall. Cloth, 2s. 6d. (3d.).

"The story has a distinct Australian flavour, and it will appeal to all boys who love a good yarn."—*Advertiser.*

"A thrilling boys' story of the exploits of two youthful adventurers, who sailed to a coral island in search of a hidden treasure."—*Age.*

"This is a stirring and not too long little volume in which young boys will revel, and which even older youths will read with interest."—*The Register.*

"Mr. Barrett has utilised his natural history knowledge in a most entertaining and instructive manner, and the story, healthy in tone, will appeal to Australian boys, for whom it has been written."—*Town and Country Journal.*

"It is credible, it is breezy and wholesome, it has genuine Australian colour, and it is thoroughly interesting."—*Triad.*

"Quite a thrilling story of adventure, in which the youthful heroes are of schoolboy age."—*Leader.*

A LITTLE BUSH POPPY. A story of Australian child life. By **Edith Grahame.** With 132 black-and-white illustrations by May Gibbs. Cloth, 3s. 6d. (3d.).

A fascinating book for Australian children.

"It's a real clean, healthy yarn for children. There's no preaching nor teaching in it, but it's just a good, healthy natural yarn."—*Stock and Station Journal.*

"We know that it appeals to healthy young girls. This is a good book of the rarer sort."—*The Triad.*

"A highly entertaining book, and one of very considerable artistic and literary merit."—*Western Mail.*

"A capital book of Australian life, with just the kind of humour that will be loved by the growing girl."—*Booklover.*

"A delightfully written book, full of real children with natural characteristics. A book well worth reading by young people, and by older ones, too."—*The Pastoral Review.*

"An admirable book for boys and girls, and should become extremely popular with little Australians, for it is fresh and wholesome and full of fun."—*Punch.*

THE SWEETHEART OF THE BUSH. By **George Sargant.** Cloth, 3s. 6d. (3d.).

The "Sweetheart of the Bush" is a deeply interesting and in many parts exciting story of life in the backblocks of Australia.

THE WINDING TRACK. By **George Sargant,** author of "The Sweetheart of the Bush." With an attractive cover in colours by B. E. Merfield. Cloth, 5s.; paper, 3s. 6d. (4d.).

Another delightful Australian story, written by one who knows his country.

AUSTRALIAN TALES OF THE BORDER. By **William McGuffin.** An highly interesting and fascinating story of the early days of Australia. Reminiscences of an actual pioneer. Full cloth. Price, 5s. 6d. (3d.).

Reminiscences of an actual pioneer.

THE ENEMIES OF LITERATURE. An address delivered to the Literature Society of Melbourne. By **Professor Murdoch.** Price, 1s. (1d.).

LET THERE BE LIGHT. By **John Enright,** Minister of the Presbyterian Church, N.S.W., formerly Rev. Father Andrew, S.J. 2nd edition. Price, 6s. 6d. (4d.).

The book is the justification of a strong man for his strong action in leaving the Church of Rome for that of the Protestants. He has a wonderful story to tell.

"Its outstanding feature is perhaps its utter lack of bitterness and vindictiveness. The keynote of his book is legitimate criticism substantiated by facts, not abuse."—From a ten-inch review in *The Register.*

"There is no sensationalism, no unhealthy revelations. He recalls his experiences as passionate preacher, and traces his spiritual development up to its culmination in another faith."—*Age.*

"For sixteen and a half years his sandalled feet trod the monastic way, and on September 11, 1907, he 'forever withdrew, not only in tears, but in peace.'"—*Advertiser.*

"From first to last it is a story of the experiences of a very active and intense mind in dispute with itself."—*The Herald.*

TRIANGLES OF LIFE. By **Henry Lawson.** Price, 5s. (4d.).

Shows the greatest Australian author at his best and widest range of power. He has written nothing more thoroughly Australian than "Triangles of Life," whilst "His Mistake" is a gem in the humour of this land. The volume contains "The Stranger's Friend" and "Mateship"—Lawson at his highest.

PAYING GUESTS. By **Tarella Quin.** Price, 4s. 6d. (3d.).

"Her ever-ready and unforced humour, which prevails throughout, her intimacy with outback conditions in Australia, and her thorough knowledge of human weakness and strength, are points calculated to bring this writer many admirers."—*The Barrier Miner.*

VICTORIAN HILL AND DALE. By **T. S. Hall, D.Sc.** Price, 3s. 6d. (3d.).

Geological articles on the country around Melbourne.

A GUIDE TO THE STUDY OF AUSTRALIAN BUTTERFLIES. By **W. J. Rainbow, F.L.S.** Price, 3s. 6d. (3d.).

"A useful little book. . . . very well executed."—*Nature.*

GINGER TALKS ON BUSINESS. By **W. C. Holman.** Crown 8vo., extra cloth gilt; 235 pages, with 15 full-page cartoons, illustrating the principles of salesmanship, which the "Talks" explain. Price, 5s. (4d.).

NO BREAKFAST; OR, THE SECRET OF LIFE. By "**Gossip.**" 5th edition. Crown 8vo.; 94 pages, antique paper; attractive cover in two colours. Price, 1s. (1d.).

THE FEDERAL LIQUOR SERVICE. By **T. Wollaston.** Crown 8vo.; 91 pages. 2nd edition. Paper cover, 1s. Also in cloth, 2s. 6d. (2d.).

This book on "The Federal Liquor Service" is the result of much thinking and investigation on the part of the author, who puts before the reader a most rational solution of the problem.

EATING FOR HEALTH. An important volume. By **O. L. M. Abramowski.** Revised by Rev. J. T. Huston. 3rd revised edition. Price, 5s. (3d.).

"It is the record of an actual experience, simply told and easily followed, and has already helped many to a more definite and enjoyable way of life."

ORA ET LABORA. A scheme of praise, resolution, self-examination, and intercession. Compiled and written by the **Rev. A. W. Tonge, M.A.,** Headmaster Trinity Grammar School. Paper wrapper, 9d. (1d.).

ELVES AND FAIRIES of Ida Rentoul Outhwaite. Verses by **Annie R. Rentoul.** New selected edition. Six pictures in full colour, and 15 full-page illustrations in black-and-white. Bound in stiff boards. Price, 7s. 6d. (3d.). The real kiddies' book.

"If you have a small boy or girl to buy presents for, you can't do better than invest in a copy of 'Elves and Fairies.' Grown-ups will surely fall victims to the quaint charm of Goblin Stars, with its fascinating reds and browns, and Moonrise is a thing of special joy, not to mention that droll little study, Bookworms."—*Punch* (Melb.).

It is full of delightful fancies such as charm the minds of children, with dainty and quaint story of fairy, elf, brownie, or hobgoblin. It would afford pleasurable reading and delightful picture studies to any child in any land."—*Argus* (Melb.).

"The drawings should win a high place as an illustrator for their maker, while the simple charm of the lyrics shows again that sweet English is spoken and written in the Southern Hemisphere as well as in the land of green fields, and ancient hedgerows."—*Books and the Book World of The Sun* (U.S.A.).

"The illustrations show us fairies and children and beautiful fanciful backgrounds drawn with a sure and accomplished touch. . . . The verses range from delightful fantasies to no less delightful descriptions of every-day children."—*Spectator* (London).

THE ART OF FREDERICK McCUBBIN. A richly-bound volume, containing 45 illustrations in colour and black-and-white by the artist, with an Essay by James MacDonald, and some remarks on Australian Art by the artist himself. 1,000 copies issued; nearly all sold. Price, two guineas (5d.).

"The work is, from every point of view, a valuable one."—*Herald.*

Art like McCubbin's is an educative and refining influence for all. It will help to open eyes that have been blind to the splendour and the loveliness of our Australian land, and future generations will value it even more than the present.

THE MEN OF TO-MORROW. By **Edith C. Onians.** Cloth, 5s. (3d.).

"Sixteen years' work among the newsboys of Melbourne made me realize intensely the necessity of understanding the great problem of Child Rescue Work."

THE SUTHERLAND MEMORIAL BOOK. By **W. A. Osborne, M.B., D.Sc.,** Professor of Physiology in the University, Melbourne. Being a Biography of the late William Sutherland. 128 pages, with three photographs and a reproduction in full colour of a water-colour sketch. Art paper wrapper. Price, 7s. 6d. (3d.).

EDUCATIONAL

THE AUSTRALIAN SHAKESPEARE. General Editor, **R. S. Wallace, M.A.,** Professor of English Language and Literature, University of Melbourne.

The Australian Shakespeare is the result of the combined efforts of the various English authorities, in the different States of the Commonwealth and New Zealand, to provide sound school texts which will meet the requirements of the Examination Boards.

1. **"TWELFTH NIGHT."** Edited by **R. S. Wallace, M.A.,** Professor of English, University of Melbourne. Price, 3s.
2. **"HENRY V."** Edited by **J. Le Gay Brereton, B.A.,** Fisher Library, University of Sydney. Price, 3s. 6d.
3. **"MACBETH."** Edited by **T. G. Tucker, M.A., Litt D.,** formerly Professor of Classical Philology, University of Melbourne. Price, 3s.
4. **MERCHANT OF VENICE.** Edited by **Walter Murdoch, M.A.,** Professor of English, University of West Australia. Price, 2s. 6d.
5. **"KING LEAR."** Edited by **A. T. Strong, M.A.,** Lecturer in English, University of Melbourne. Price, 3s.
6. **"AS YOU LIKE IT."** Edited by **Frank Tate, M.A., C.M.G.,** Director of Education, Melbourne. Price, 2s. 6d.
7. **"HAMLET."** Edited by **W. H. Williams, M.A.,** Professor of Classics and English Literature, University of Tasmania. **(In the Press.)**

(Other plays in preparation.)

"There are doubtless school editions of Shakespeare which contain a greater mass of general or special information, but this Australian Shakespeare contains all that students need to know, and presents each play as a still living and interesting story about human beings."—*The Times* (London).

THE ELEMENTS OF ANIMAL PHYSIOLOGY. By **W. A. Osborne, M.B., D.Cs.,** Professor of Physiology in the University, Melbourne. 152 pages; 64 illustrations, with appendix. Price, 6s. 6d. (1d.).

A SCHOOL TREASURY OF ENGLISH LITERATURE. Selected by **Professor W. Murdoch, M.A.** 448 pages. Cloth, 5s. 6d. In sections: Part I, 2s. 6d.; Part II, 2s. 6d.; Section IV, 1s. 6d. School Notes to Sections I and IV edited by Enid Derham, M.A. 6d. each.

A selection of prose and verse taken from the great English writers. It has been adopted by the Universities of Melbourne and Adelaide for English Public Examinations, which fact alone proves its quality.

ENGLISH GRAMMAR, Descriptive and Historical. By **T. G. Tucker, Litt. D. (Camb.); Hon. Litt. D. (Dublin);** Professor of Classical Philology in the University of Melbourne; and **R. S. Wallace, M.A.** (Oxford), formerly Professor of English Language and Literature in the University of Melbourne. Price, 3s. 6d.

"The Grammar is admirably arranged, clearly written, and displays throughout a tone of enlightened common-sense rather than the pedantry so often associated with the study of this subject."—*Journal of Education.*

AUSTRALIAN TEXT-BOOK OF CHEMISTRY. Part I. By **W. R. Jamieson, B.Cs. Hons. (Lond.),** Senior Chemistry Master, Scotch College, Melbourne. 367 pages; cloth. Price, 6s. (4d.).

A first book in experimental chemistry intended for pupils in senior classes in primary schools, or those who have just entered upon a secondary course.

NATURE IN FARMING. By **John W. Paterson, B.Sc., Ph.D.,** Professor of Agriculture in the University of Western Australia. 213 pages. Price, 5s. (3d.).

An excellent treatise, cleverly written and splendidly arranged. It is just the book which will increase the product of farm or orchard.

THE COMMONWEALTH NATURE STUDY BOOK. Part I. By **Alfred George Edquist,** Supervisor in Nature and Science in Primary Schools, Education Department, South Australia. 176 pages; illustrated. Price, 3s. (3d.). Approved as a text-book. Australian Nature Study clearly and freshly set out.

AUSTRALIAN TEXT-BOOK OF CIVICS. By **I. D. Marshall, M.A.,** Somerville College, Oxford, Mistress of Method, Melbourne University; and **Alice Hoy, M.A.,** Final Honour Scholar in History, Melbourne University, Wyselaskie Scholar. With an introduction by Frank Tate, M.A., C.M.G., Director of Education, Victoria. 129 pages. Price, 3s. (3d.).

BERNARD O'DOWD'S WORKS

This writer is surely in the forefront of Australian authors. Critics are unanimous in their opinion regarding the unique and high quality of Mr. O'Dowd's work.

DAWNWARD. Price, 2s. 6d. (1d.). A few copies of the original limited First Edition, published by "The Bulletin" Company, are still available. Price on application.

"The best book of verses yet produced in Australia."—T. G. Tucker, Litt.D., Prof. of Classical Literature, University of Melbourne.

THE SILENT LAND, and Other Verses. Bound in half-cloth boards, gilt tops. Price, 2s. 6d. (1d.). A few copies of an Edition-de-Luxe (limited to 25), signed by the author, are still available. Price, 7s. 6d.

"The most arresting work of the younger generation is that of Mr. Bernard O'Dowd."—*The Times* (London).

DOMINIONS OF THE BOUNDARY. 64 pages; Art cover. Price, 1s. (1d.).

"Mr. Bernard O'Dowd stands alone among modern Australian poets."—*The Spectator* (London).

THE SEVEN DEADLY SINS: A Sonnet Series. Small quarto, 56 pages, deckle-edged, antique paper. Price, 3s. 6d. (1d.).

"It is full of thought and vision. It embodies such a bold and luminous re-valuation of the universe, as we have every right to expect from the true poet."—*The Herald.*

THE BUSH. Small quarto; Art paper cover. Price, 2s. 6d. (1d.).

"It is the most significant of all the poems, of any considerable length, that Australia has yet produced."—*The Argus.*

"It takes rank at once as a great national poem. It should be bought and read, and re-read, by every thoughtful Australian."—A. T. Strong in *The Herald.*

DAINTY BOOKS BY GREAT AUSTRALIAN AUTHORS

A Series for good Australians to buy

Bound in attractive paper covers. Price, 1s. 3d.; postage, 1d.

SEA SPRAY AND SMOKE DRIFT. By **Adam Lindsay Gordon.**

A dainty miniature edition of Gordon's classic.

POEMS OF HENRY C. KENDALL.

A selection of this favourite Australian poet's best work.

POEMS. By **Bernard O'Dowd.** A neat volume of selections.

POEMS OF WILLIAM GAY. A carefully-made selection.

POEMS OF JESSIE MACKAY.

POEMS BY JENNINGS CARMICHAEL (Mrs. Francis Mullis).

MATESHIP: A Discursive Yarn. By **Henry Lawson.**

Lawson at his highest and best.

STRANGER'S FRIEND. By **Henry Lawson.**

An Australian Xmas Carol.

BUSHLAND BALLADS. By **Edwin J. Brady.**

POETRY

SEA AND SKY. By **J. Le Gay Brereton.** Price, 3s. 6d. (2d.).

SATYRS AND SUNLIGHT. By **Hugh McCrae.** 2nd edition. Cloth bound, crown 8vo. Price, 3s. 6d. (2d.).

PURPLE AND GOLD. By **F. S. Williamson.** Price, 3s. 6d. (2d.).

These three books with "The Bush" worthily represent Australian poetry and show it at its very best.

These four books will more than hold their own with any other poetry written elsewhere during the last twenty years.

Have you read these four books?

THE WAYS OF MANY WATERS, and Other Verses. By **Edwin J. Brady.** 2nd edition. Crown 8vo. Illustrated by Alex. Sass. Price, 3s. 6d. (3d.).

POETICAL WORKS OF WILLIAM GAY. With a biographical sketch by J. Glen Oliphant. Price, 3s. 6d. (3d.). The authentic and only complete edition.

Prof. Dowden.—"Noble in feeling and dignified in expression, each sonnet moving with a grave music towards its close. They are admirable both for thought and workmanship."

APPASSIONATA. By **Fritz Hart.** Crown 8vo. Cloth cover, gold blocked, gilt top. Price, 3s. 6d. (3d.).

FOR AUSTRALIA, and Other Poems. By **Henry Lawson.** Price, 5s. (3d.).

AUSTRALIA IN PEACE AND WAR. By **W. M. Fleming,** M.H.R. Price, 5s. (3d.).